DECEMBER 15, 1958 PRICE 50 CENTS

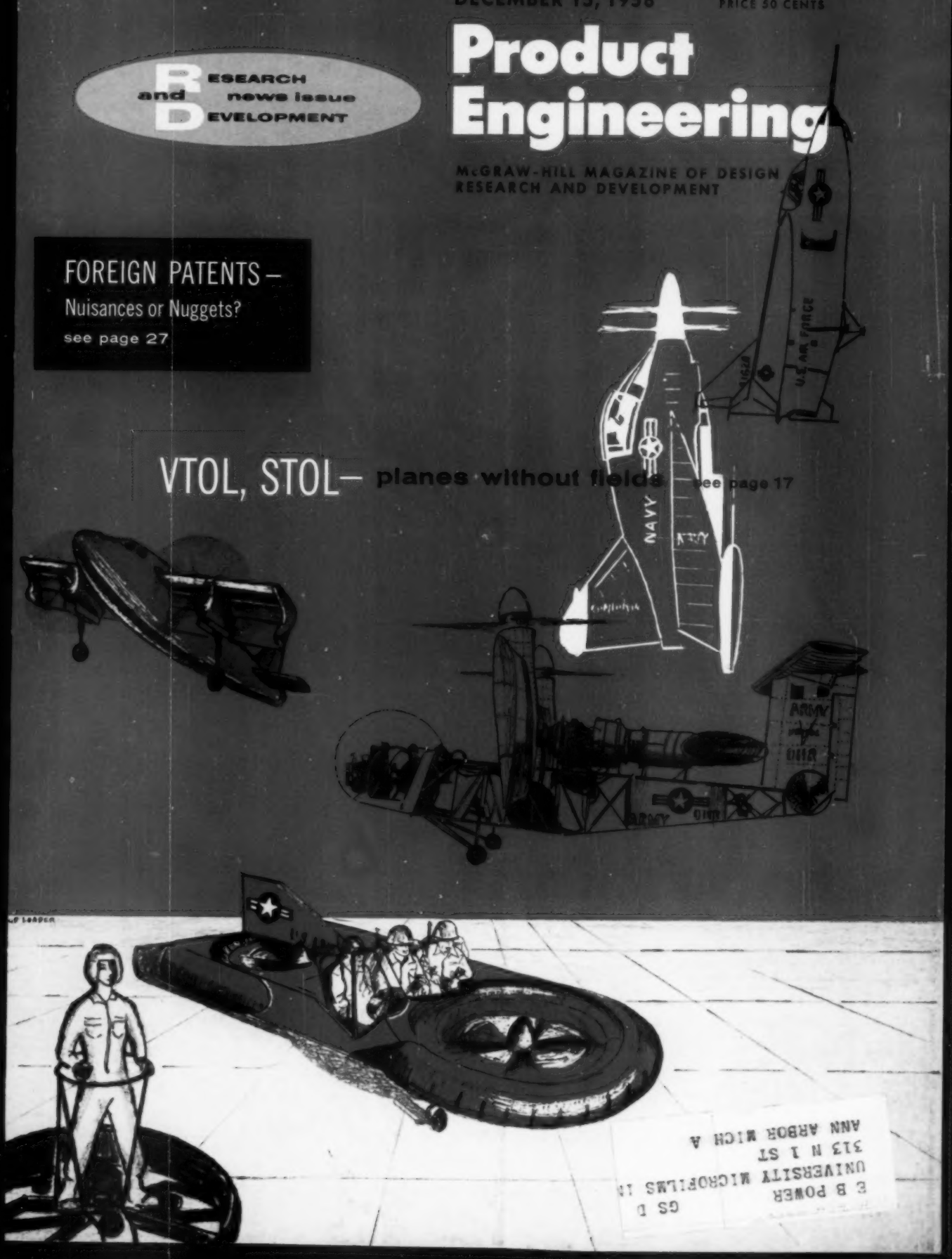
Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN RESEARCH AND DEVELOPMENT

R and D RESEARCH and DEVELOPMENT news issue

FOREIGN PATENTS—
Nuisances or Nuggets?
see page 27

VTOL, STOL— planes without fields see page 17



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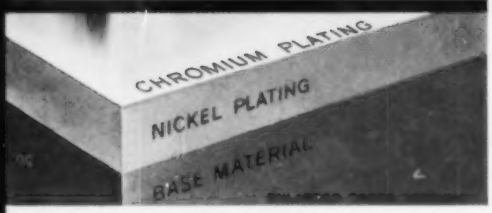

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Why R & D?

How is it done?

What are the results?

Surveys and curves don't tell the real story, so we sent Ford Park, Associate Editor, to a selected group of typical OEM companies having vigorous R & D activities.

These companies suffered the pitfalls and setbacks natural to company research. But they solved their problems and came out stronger, better organized, and more firmly convinced of the value of research.

Take advantages of their experience.

Watch for the

December 29 issue

and

Your passport to tomorrow.

coming next week . . . the DESIGN issue for December 22

FEATURING

- **New gear standards span wide quality range**
  For the first time, an all-inclusive standard for spur and helical gear specifications

- **Plasma-arc plating—a new production process**
  At 15,000 F and higher this torch will vaporize any known material.

- **Where vacuum forming stands today**
  Improved methods offer deeper parts, more complex design with thermoforming.

- **How to sound-test at 150 db.**
  Special speakers and a pentagonal sound chamber simulate noise of rocket-powered missiles.

- **Manganese joins aluminum to give strong stainless**
  A progress report on a Navy-sponsored project for high-strength austenitic Al-Mn steel.

- **Check these mechanical features of a fhp motor**
  A guide to enclosures, mounting arrangements, bearing types, insulation, and those "extras".

- **22 simple locking devices**
  Latches, eccentric cams, springs and other arrangements that hold two parts together.

Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

R and D RESEARCH and DEVELOPMENT news issue

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Product Engineering . . . . . SIDELIGHTS

R ESEARCH and D EVELOPMENT news issue

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● **Vertical takeoff aircraft** get stranger and stranger. The original sit-on-your-tail-and-blast-off type has sprouted rotors and jets and deflecting vanes, and one (p. 17) looks somewhat like a ducted fan set on its back. These designs—both flying models and artist's conceptions—lend credence to the persistent rumor of an American Air Force contract for a flying saucer to be built by A. V. Roe in Canada. Strictly secret (and understandably so), the whole project speaks well for the imagination and foresight of Pentagon officials. After all, if little green space-beings choose the saucer shape, there must be something in it besides cooling coffee.

● **The discussion of cryogenics** (p. 10) required some careful stepping among Fahrenheit, Centigrade (or Celsius), Kelvin and Rankine scales. The British Association for the Advancement of Science condemns this foolishness as well as the various inches, feet, pints, gallons, yards, pounds and bushels that calmly fly in the face of metric logic. Even worse, British and American yards are different (by 0.0003%), as are their bushels (by 3.2%) and their gallons (by 20.1%). The BAAS has started an inquiry to find out how much it will cost Britain to make the change —and whether they can afford *not* to make the change. Amen and we too.

● **An aviation electronics bookshelf** we passed the other day brought on so sad-sweet a rush of nostalgia that we felt you might like to share it. Next to a stack of technical magazines stood *Advances in Electronics*, then *Fundamentals of Vacuum Tubes* and finally *Tom Swift and his Sky Racer* in the original edition.

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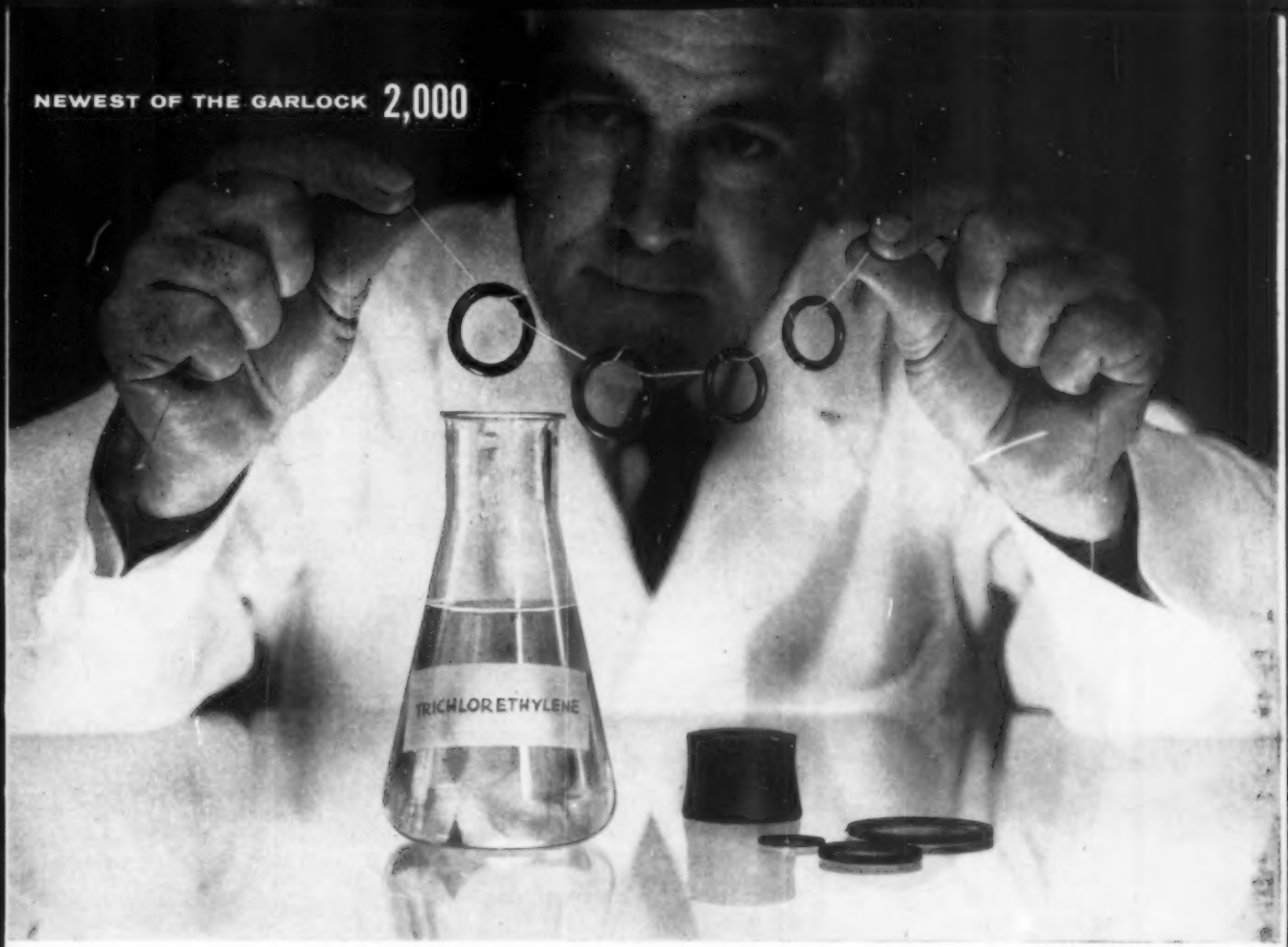

New Garlock Viton* Rubber Parts Offer You Low Swell in Solvents, Resistance to 600°F.

LOW SWELL, GOOD TENSILE STRENGTH DESPITE HEAT, SOLVENTS. Today's era of tremendous horsepower dictates that rubber be able to withstand not only corrosive fluids alone—nor high temperatures alone—but a combination of both. Garlock's new VITON rubber parts do exactly this. It's the only known rubber that will maintain low compression set, low swell, and good tensile strength in contact with most solvents at high temperatures.

IMMERSED FOR SEVEN DAYS. For example, Garlock VITON retains its duro, tensile strength, and elongation characteristics when immersed for one week in twenty of the most widely used—and perhaps harshest—solvents, lubricants, fluids, and acids on the market today. In the test illustrated two O-rings of ordinary Nitrile rubber and two rings of VITON were immersed in trichlorethylene; VITON (right) retained its original dimension—the Nitrile rubber (left) swelled almost 50%.

OVEN AGED AT 600° F. VITON can be oven aged in air at 600° F. for 24 hours, and at 400° F. for 2400. In both cases, it not only retains its excellent mechanical properties, but it remains usefully elastic, proving its value on either intermittent or continuous application.

OPENS MANY NEW USES. Jets and missiles are the more obvious applications for Garlock's new VITON (meets applicable military specifications for military aircraft, etc.). However, VITON is finding important new civilian uses as valve stem seals on truck engines, pump seals on automatic transmissions, and on gasoline pumps, thermostat bellows and domestic washing machines—practically any mechanical equipment where you need rubber parts which give maximum resistance to deterioration by liquid or heat.

VITON is also available as sealing elements in KLOZURE** Oil Seals, flexible members in MECHANIPAK** Mechanical Seals, "O" Rings, Cups, CHEVRON** Packing. VITON products are the newest of the Garlock 2,000 . . . two thousand different styles of packings, gaskets, and seals for every need. The only complete line. See your local Garlock representative, or write for further information.

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READER TO EDITOR

Patent Rebuttal

To the Editor:

The rebuttal to my article offered by Mr. Robert G. Crooks (*Nov 3, p 24*) was intelligently presented and not the vitriolic, emotional attack which other attorneys have concocted. In every significant detail Mr. Crooks substantiated the position which I presented in the July 28 issue. If we disregard his professional advice about the measure of merit, originality, simplicity, etc., with which he filled out his rebuttal, every other essential comment proved my point! I believe it ought to have "gone without saying" that the discussion was based on actual invention and a valid patent. It was not my intention to propose any form of support for the "paper patents" and "non-inventions" which litter the files in the Patent Office.

The basic point which all patent attorneys overlook and which all corporations tend to ignore is that individual inventors are totally deprived of patent rights unless they have money to, protect themselves. This situation is fundamentally antisocial and is destroying the strength of this country, just as the British industrial monopolist, destroyed the strength of their industrial revolution by adopting the attitude that "inventors will invent whether or not they are compensated for their inventions." The Russians now are moving ahead of us technologically. We continue to exploit our inventors because "they will invent whether paid or not."

The difficulty with this modern form of robbery through law is that the productive capacity of inventors is not adequately used for the common good. The poor inventor cannot really contribute to the common needs of our society. Robbed of his first developments, in disgust he ceases to produce any further.

Mr. Crooks said "the little man can patent and successfully exploit inventions, either as a member of a corporate team or on his own account." This bald statement is then completely refuted in all respects by the necessity to have enough money to protect it against thieves or the necessity to finance it for "independent development."—DAVIDLEE VON LUDWIG
Brooklyn, NY.

To The Editor:

I've taken the liberty of rewriting Robert G. Crook's recent (*PE—Nov 3*) article on the inventor's ability to exploit his own patents.

Primer of Patents:

Be sure that you have invented something. Only the Supreme Court really knows this: So save time and give up now.

Have a novelty and patentability search made. The reference which will be cited against you later may come from Azerbaijan or Zanzibar or points between, but a search will keep everyone busily and profitably occupied.

Go over the invention with your patent attorney. Get his opinion as to its ultimate merit and exploitability. He's required to have second sight in order to deal with the Patent Office: Let him use it in your behalf.

File a patent application. The first office action will be a rejection. Don't, above all, give up now. Try again.

Exploitation:

Once you have an office action which isn't an outright rejection begin trying to exploit the invention.

If you lack resources to exploit the invention yourself give up *now*. If you don't have enough to exploit it, you don't have enough to protect it.

So you approach a corporation. If it is already in the field of your invention, it has something like it and doesn't need it. If it's in another field, why did you go to that company in the first place?

Your patent issues . . . but maybe it's not valid. Can you stand a suit to protect it? All right, why is this such a shock? Maybe the company that picked up your idea really thinks you can't protect it. It likes the idea well enough, but what screaming injustice it would be to ask the company to take the originator along with the idea!

Bring patent cases under criminal law? What a terrible hardship for the manufacturer! If you can just persuade an infringer to move to China, you can kill yourself on his doorstep and haunt him. It's perfectly legal. —ROGER MARSH
Hudson, Ohio

P. S. Your Nov 17 issue (asking: "Are You creative?") just arrived. Lacking a wife to evaluate me, I asked another member of the family how I measured up. She said I *must* be the creative type: I'm the messiest !?!&$) she has ever encountered. Unfortunately, this compliment has been largely offset in my mind by my own knowledge of my defection. I just bought two new suits—both tweed. The conventionality needs only a pipe to complete the "tweedy" look.

Deluge of Paper-Clips

To the Editor:

Your "Sidelight" on paper clips (Oct 20, p 2) did more than amuse me. My own studies may solve your dilemma but suggest another.

Six months ago, on changing offices, I found my clip compartment empty. No kind secretary had filled it. Using clips fast, 10 per day, and dividing the number of clips, just inventoried, 15, by the number of days, 183, yields the Paper Clip Birth Rate, or 0.082 clips per day. When you consider the number of clip users, this small number represents a staggering annual increment. Defense measures may be called for lest we be up to our ears in paper clips as well as papers.

—E J KALISKI
E I du Pont de Nemours & Co.

DEVELOPMENTS TO WATCH...

Manganese-steel parts doubled in strength . . .

. . . and made twice as hard in an instant. . . . That's the promise of an explosive hardening technique now ready for design evaluation.

It's a DuPont process based on a special form of its PETN (pentaerythritol tetranitrate) explosive—a flexible sheeting that can be wrapped around finished parts of almost any shape. It's safe to handle; but, when detonated, DuPont says, it accomplishes in an instant a degree of hardening—to a depth of an inch or more—normally achieved only in long-term service.

Annealed austenitic manganese-steel castings can be boosted from Rockwell C 20 to C 40-45; and strength can be raised from 135,000 psi to nearly twice as much.

The process is already in use at Taylor-Wharton, which worked with DuPont on the process; and several other companies have it under test. DuPont says it is now set up to treat parts on a semicommercial scale and to prepare test lots for design evaluation.

The explosive itself is produced in 10-by-20-in. sheets, in thicknesses ranging up from ☆ in., and costs $5 to $6 a lb. (For ☆-in. material, there are about 225 sq in. to a lb.)

High-purity lead is getting close attention . . .

. . . as its unique properties—physical, nuclear, and magnetic (see below)—are recognized.

At Naval Research Labs, for instance, this material is helping to uncover the relationship between applied stress and steady-state creep at high stresses.

At stresses less than 3000 psi, says NRL, "the steady-state creep rate of many metals is proportional to the applied stress raised to some power (usually 4.5) . . . but at high stresses this power law is no longer obeyed." The stress at which the power law breaks down seems to increase as the elastic modulus of the metal increases, in metals with small as well as those with fairly large elastic moduli. Using lead as an example of the former and aluminum and nickel as examples of the latter, NRL scientists find the critical stress of lead (3.5×10^7 dynes/cm^2) is well below that of aluminum (2.4×10^8) and nickel (8×10^8). The corresponding figures for elastic moduli are 7.3×10^{10} for lead, 2.4×10^{11} for aluminum, and 7.5×10^{11} for nickel.

New data on working height . . .

. . . comes from a survey by the Packaging Institute.

To the question: *Do you have a standard height for packaging-line conveyors?* 53% of those replying said Yes; 47% No.

Of those who did have a standard height (approximately 25 companies), about 13 had standardized on 36 in. No other height was mentioned by more than three companies: 37, 31, 33 and 34 in. each had two or three backers; 39, 35, 32, and 40 in. received only one mention apiece.

Copies of the complete report are obtainable from the Institute for $1.

Progress in magnetic refrigeration . . .

. . . for producing ultralow temperatures (see p 10) is reported by Arthur D Little Inc.

This is the system in which a paramagnetic salt is alternately magnetized and demagnetized, much as the fluid in a conventional refrigerator is alternately compressed and expanded.

Early models failed to reach or maintain the expected low temperatures. The reason: iron alum, the salt used, loses its paramagnetic properties if warmed above 86 F. But with care in fabrication, and an improved design, ADL says refrigeration cells can now be produced that will maintain 0.25 K continuously; and thinks it will be possible to reach 0.1 K or even 0.05 K "within a year or two."

The present design: a nickel-silver case, protected by a resin coating, a central cluster of silver-plated copper fins to collect the heat; and a hard-packed alum filling. The cell is connected to pure lead strips, which can be switched magnetically from thermally conducting to nonconducting. —ARG

MUELLER BRASS CO. forged gears improve dependability and performance of BODINE electric motors

For combined high shear strength and maximum wear life in their single and double reduction speed reducer motors, Bodine Electric Company of Chicago uses gears forged from Mueller Brass Co. 603 Alloy.

Bodine has specified Mueller Brass Co. forged gear blanks because of their consistently high quality . . . there is no porosity, foreign inclusions or defects typical of cast blanks. The hot working of the metal followed by heat treatment to the desired physical properties produces a refined grain structure to give uniform machining and wear in service. The forged blanks are consistent in size and held to close tolerances. Bodine has also found that the excellent machinability of the blanks in the hobbing operation increases overall hob life.

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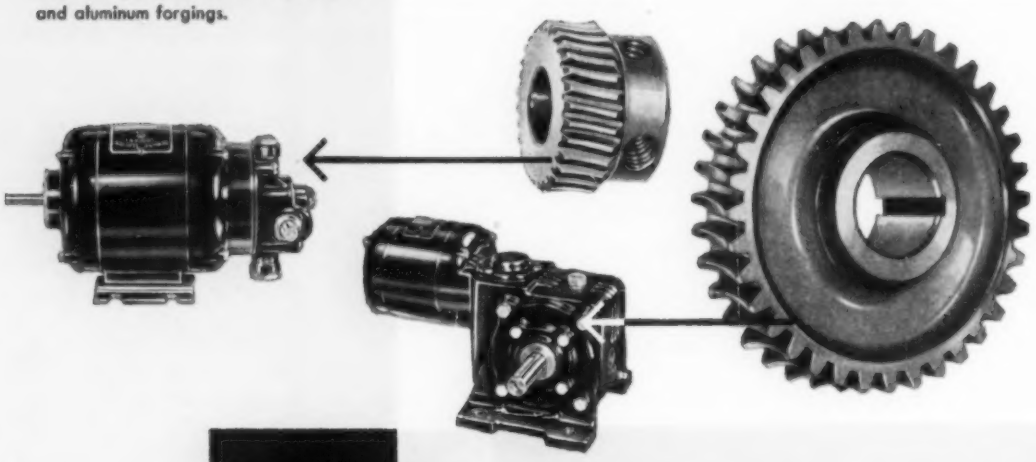

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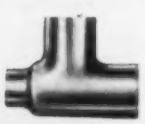

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DEVELOPMENTS TO WATCH...

The year's military budget . . .

will show research and development expenditures of well over $6 billion, compared to this year's $2.3 billion. But it doesn't mean R & D is trebled.

Next year, for the first time, Pentagon officials are considering a plan to include in the R & D budget breakdown costs of prototype fabrication and testing and evaluation of new weapons—expenses which have been classified as "procurement and production" and run to $4 billion a year.

The move is geared to counter charges that the military services don't spend enough for R & D. They claim the budgets up to now, however, don't reflect all R & D spending. Now they want to wrap everything related to weapon development under the R & D label.

Here is where the military's R & D money goes for this fiscal year: of the $2.3 billion that will be spent, about 8% will go into aircraft; missiles will get 25%; ships 4%; other equipment 7%; military sciences, including basic research about 9%; operation and maintenance facilities 16%; space 19%; and an emergency fund of around 5%. Spread throughout other programs is electronics R & D.

Next year, the Pentagon expects a slight drop in R & D for aircraft, combat and support equipment. Missiles and space research will be increased.

The issue of air pollution controls . . .

bears watching. The subject is creating a stir in both government and industry circles.

Thousands of tons of pollutants go into the air each day and it is costing the nation from $4-$7 billion a year, not counting health hazards.

The situation has caused communities to start slapping on severe control measures. Los Angeles told industry it can't use fuel oil during intense smog. Natural gas must be burned instead.

Tests are starting this month at the public health service's Robert A. Taft Sanitary Engineering Center in Cincinnati to determine the effects of various types of gasoline exhaust on animals.

Secy of Health, Education and Welfare, Dr. Arthur S. Flemming is calling together industry, state, local and federal officials to map out a nationwide research program. The group, expected to meet in early 1959, will also recommend how much dollar support each group should contribute.

A two-year study made by federal and local air pollution officials in Louisville, Ky. in 1956-57 pointed up the corrosive effects of polluted air. Steel spring test specimens exposed to these conditions showed a definite decrease in tensile strength.

The full extent that air pollution contributes to corrosion was not determined in the Louisville test. But, it was important enough to cause the group to recommend that a regulation be installed stipulating the maximum amount of sulfur content coal that is used in the area could contain.

Currently, the most inclusive air pollution test conducted so far is underway at Nashville, Tenn. It means that air pollution controls will soon be affecting virtually every industry in the nation. On the plus side, the market is wide open for devices that will economically control pollutants.

The Air Force "make or buy" contract clause . . .

will go into effect within a few weeks. This highly controversial clause has already been approved in Washington and is being circulated to procurement offices. Other services may adopt the procedure.

The new contract clause is aimed at tightening the Air Force's control over the amount of subcontracting work in contracts. When contracts are written, they must include an AF approved "make-or-buy" list that shows components to be made by the prime contractor and which ones to be subcontracted.

A "make-or-buy" decision is required: if production of the item by the prime contractor creates a need for additional Government facilities; if the in-plant work proposed by the prime contractor is significantly different from the normal in-plant operation; if the item has been subcontracted and the prime wants to pull it back into his own plant where Government facilities would be used; and other management considerations.

Not all contracts must carry "make-or-buy" clauses. Exempt are formal advertised procurement contracts, some fixed price contracts, most contracts for less than $350,000, and some R & D contracts.

If contractors don't abide by the "make-or-buy" clause, the Air Force can withhold use of Government facilities by the contractor.

World-wide ...

DEVELOPMENTS TO WATCH...

Russians are rockin' the rock . . .

. . . quite literally. They claim to have developed an electromagnetic mining device that uses radio-frequency power to disintegrate rock.

Power is supplied "in continuous radiations" at a frequency of 3000 megacycles and 2.5 kw. When the device is directed at the rock, say the Russians, "the energy of these electromagnetic waves is transformed into thermal energy. The resulting stresses cause crystal and layer displacements which result in disintegration of the rock mass."

A more powerful unit, now under development, is expected to be effective on both hard and soft rock, and "may become the universal mining machine of the future."

New way to metallize ceramics . . .

. . . is being developed by Standard Telephones & Cables Ltd, London. In place of the metal powders normally used for sintered coatings, the company is working with mixtures of manganese oxides and iron, molybdenum, tungsten, and nickel. Advantages, say the British: usually good adhesion to the forsterite ceramics normally used for electron tubes, and relative ease of application. Best mixture so far: manganese dioxide and molybdenum. Firing temperature is about 2375 F.

Stereo hearing aid . . .

. . . is claimed by a Dutch concern. The basic unit has an earpiece and a tiny case that fits directly behind the ear. Total weight: about an ounce (27.5 gm).

It has a sensitive magnetic microphone; an amplifier (three transistor stages connected through a resistance, plus a miniature potentiometer which controls amplification and incorporates an on-off switch); and a small mercury cell to supply the power.

The stereo feature? It's light enough so one unit can be worn on each side, the manufacturer claims, and the earpiece is so designed that plugs can be inserted into it to equalize hearing in both ears and "restore normal stereophonic perception," as is done in American units contained in eyeglass bows.

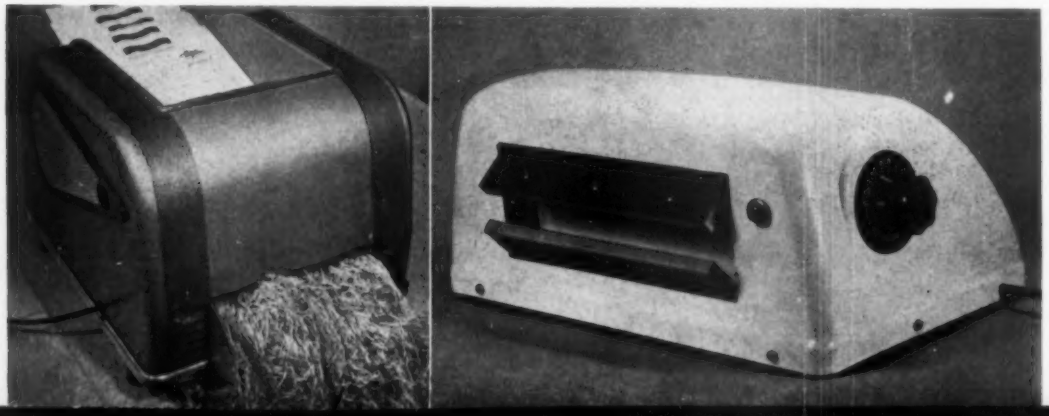
Bench-size equipment . . .

. . . has taken the Germans' fancy, and they're hoping the two units pictured here will also attract American dollars.

The paper shredder (left) can chew up as much as 100 lb of documents an hour, features sealed-in lubrication, smartly styled case. For deluxe shredding, the company, Bueroma GmbH, Idsteinerstrasse 14, Wiesbaden, offers one model "encased in a desk-height wood cabinet, to match office decor." It has twice the capacity of the standard unit too.

The heat-sealer (right) aims at the growing market in prepackaged food, hardware and the like, and has one feature that should be especially welcome: Controls can be preset "in accordance with the type of plastic used" so sealing and release are automatic. It was developed by Herfurth GmbH, Beerenweg 6/8, Hamburg-Altona, which also makes transistorized radiation detectors and other instruments.

New German machines are designed to mechanize manual chores. Paper shredder at left; heat-sealer at right.



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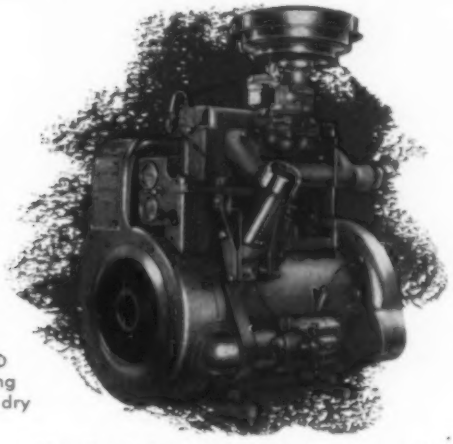
by HERCULES



HERCULES C2-90D
Design by Lycoming
35 HP; 274 pounds, dry

HERCULES CV4-180
Design by Lycoming
70 HP; 463 pounds, dry

No other industrial air-cooled engines pack the horsepower/pound of these two- and four-cylinder models. Modern design gives them 40-90% more HP per cubic inch displacement. Add to this high usable power, the economy of these engines . . . up to ½ in fuel savings over competitive engines . . . and you've got an unbeatable combination for your equipment power or power-unit applications.

The Hercules industrial air-cooled engines of Lycoming design have the dependability and endurance for which the Lycoming name is famous in aircraft engines. Crankshaft design is oversize and all bearings are of the replaceable type. With overhead valves, "top-overhaul" is fast and simple on these Hercules units; in fact, complete engine rebuild can be accomplished without removing the engine from its mountings.

Lubrication is by force-feed system with the oil fed from the crankcase to the engine's moving parts by gear-type pump through a pressure relief valve.

Available as engines or complete power-units, with accessory equipment to match service conditions, these engines have been refined by Hercules and are backed by Hercules reputation for quality, stamina and engineering excellence. Prompt service is available through Hercules world-wide distributor organization.

For further information, write Hercules Motors Corp., Dept. 100, Canton 2, Ohio. Other Hercules engines from 5 to 475 HP.

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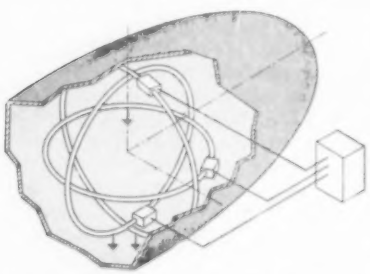
Canton, Ohio

What's happening in SCIENCE

These hoops for space travel

It's a directional-control system . . . it can also serve as a liquid-storage system . . . and it's right in tune with the times because it uses a set of hoops. Liquid is pumped through them at varying speeds in this idea developed by R. P. Haviland of GE's Missile & Space Vehicle Dept. The change in amount and speed of liquid in any given hoop determines the force applied in any one direction, and so should act as fin or rudder for a space craft. (As Haviland points out, fins, ailerons and other devices based on air drag cannot be used in airless outer space.)

The system is controlled by sensing devices (in box at lower right in diagram). They activate pumps that accelerate the liquid in such a way as to create a torque within the craft and counteract the disturbance, returning the craft to the preferred position.



Space rudder is designed to use the force of a moving liquid to change the craft's attitude. Small boxes on hoops are electromagnetic pumps.

Ceramic sponges to sop up wastes

Cellular ceramics are under test at Los Alamos Scientific Laboratory as a medium for disposal of radioactive wastes, and they look quite promising. Made by Coors Porcelain Co, the "sponges" can take up as much as 50% by weight of radioactive material, are then fired (at about 2400 F) to "fix" the material. Several types of "sponges" are being studied: some made by leaching or burning out such materials as naphthalene, wood, and cork; others gas-foamed like plastics or metals. Clay-type materials which are naturally absorptive (calcined clays, diatomaceous earth) are also under test.

Problems still remain in disposing of the gases produced during the fixative firing, and in the fact that the finished material obviously takes up more space than the original wastes. But the system does appear effective for long-term storage and seems to rate further investigation.

Amplifiers from the freezer

To raise the performance, drop the temperature . . .

That's what a good many research labs are doing these days—to take advantage of the unusual electrical effects that occur, or can be controlled, only at temperatures close to absolute zero (*PE*—Dec 2, '57, p 16). A host of new electronic devices, noted for their low noise and high performance level, are coming from this research, among them: masers (*PE*—Jan 13, p 10) and parametric amplifiers.

Masers are devices that take advantage of the ability of certain atoms and molecules (ammonia gas, semiconductors) to exist at more than one energy level. When an atom or molecule of this type is raised to its highest energy level, it absorbs energy. Reversing the reaction—as when a maser receives a microwave signal—makes it give up this energy, thus amplifying the signal it has received. It is this characteristic from which the term "maser" is derived.

It is a combination of the initial letters of: *microwave amplification* by *emission* of *stimulated radiation*.

Parametric amplifiers (also known as varactors) likewise take advantage of unusual electrical properties of such materials as semiconductors and ferrites. Here, it is the ability of these molecules to vibrate at controlled frequencies when placed in an electrical field that is important. By controlling the parameters of the electrical circuit, it is possible to control that vibration; and, again, to amplify a signal.

Ultralow temperatures are essential for masers, to prevent premature discharge of energy and to reduce the unnecessary motions of the atoms—motions that create "noise." Most paramps, on the other hand, operate at room temperature; but it has been found that noise is reduced when they operate in a bath of liquid nitrogen.

At a recent ceremony marking installation of the 100th cryostat, representatives of Arthur D Little Inc, which builds this liquid-helium cooler, and Sylvania Electric Products, in whose lab this unit was installed, pointed out that much remains to be done in the areas of miniaturization and ruggedization before such low-temperature devices as masers can be considered truly commercial.

Right now, though the heart of the maser may be only a tiny semiconductor crystal, it takes a good-size room to house all the equipment for operating it and keeping it cool.

Gerhard Weibel of Sylvania was making a real prediction when he said, "It is quite feasible that, within a reasonable length of time, a plug-in, self-contained refrigerating system can be developed which is, at least, no bigger than a filing cabinet or two." Sylvania is pointing its research in that direction and, at the same time, developing new materials and new activation systems to improve the performance of the maser still further.

What pressure can do

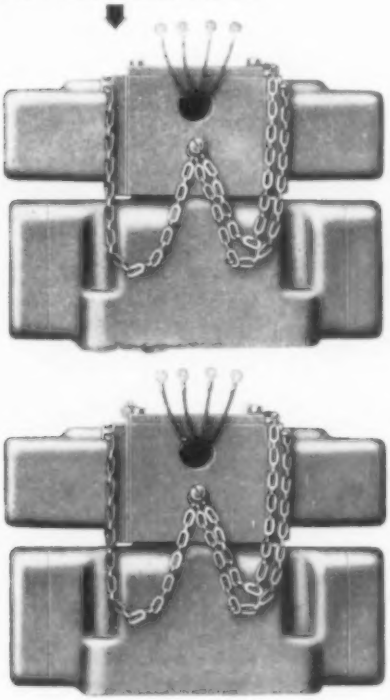
Soviet studies at 5 million atmospheres bear out the findings of US scientists (*PE*—Aug 11, p 10) that ultrahigh pressures can cause changes in electrical conductivity and light sensitivity as well as in such physical properties as density.

Using explosives as a pressure source, the Soviets have been concentrating on studies of lead and bismuth because these metals show the greatest increases in density (over 200%) at pressures of 400,000 atmospheres or more.

One interesting finding: Structural rearrangement at ultrahigh pressure is "unbelievably rapid," not a matter of slow adjustment to changed conditions.—ARG

A LOGAN HYDRAULIC CONTROL VALVE

2 competitors' control valves



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What's happening in MATERIALS

How cost patterns are changing: Metals

What will happen to metals prices in 1959? It would take more than a crystal ball to provide a flat prediction; but changes in the past year indicate a three-pronged pattern: The high-volume, low-priced metals (steel, aluminum, copper, lead, and zinc) are rising; the low-volume, high-priced metals (rare earths, "exotic" metals, titanium, zirconium) are coming down; and those in the middle (magnesium, nickel) are holding steady (see chart below).

There are exceptions, of course.

Molybdenum's price has recently gone up (about 5% on most fabricated materials).

Tin is rising—though still holding below $1 a lb.

Reviving interest in titanium and elimination of three producer-teams, reducing potential oversupply, discourage further price cuts in this metal, too. When one producer cut prices in November, the others did not hurry to follow suit.

The acute pressure on the price of at least one of the Big Three—copper—was traceable primarily to a strike situation rather than booming demand. There may be further labor unrest. But, as the *Value Line* points out, several factors—unusual mine capacity in the US, good inventories, the end of stockpiling—should militate against a runaway price spiral.

Aluminum's price today is lower than a year ago; but it hit bottom in April, and has since moved up. Again, no immediate price change is expected; but if it comes, it is likely to be "up."

Metal Prices

	December 1958	December 1957	Current Trend
Steel CR sheet	0.06275	0.0605	↑
Aluminum ingot	0.268	0.281	↑
Copper electrolytic	0.290	0.260	↑
Magnesium sheet	0.779	0.779	→
Nickel CR sheet	1.260	1.260	→
Titanium bar	5.10	6.15	↓

New light on high-temperature alloys

"Minor" amounts of such elements as boron and zirconium may have more effect on creep-rupture properties of some heat-resistant alloys than major variations in melting practice, a U of Michigan study indicates.

Vacuum melting did reduce corner cracking and improve surface and structural uniformity as compared with heats melted in air; but the biggest improvement in creep-rupture values for the complex alloy (55 Ni, 20 Cr, 15 Co, 4 Mo, 3 Ti, 3 Al) tested was achieved by increasing—only slightly—the boron and/or zirconium content.

At 1600 F and 25,000 psi, samples with less than 0.01 Zr, and less than 0.001 B, whether vacuum or air-melted, showed a rupture life of no better than 100 hr. Adding as little as 0.01 B and/or 0.1 Zr jumped that figure to the 300-to-500 range. Creep rates showed similar improvement.

Work was sponsored by NACA, and research is continuing.

Insulation problems: answers to come

The electrical insulating needs of the power industry can largely be met, says T. D. Callinan of IBM, with asbestos, glass fiber, silica fiber and glass-flake papers; phenolic, alkyd, polyvinyl, polyester, and urethane enamels; cellulose triacetate and polyester films; and chlorinated, silicone, and fluorocarbon dielectrics.

Not so, the needs for communication, and automatic detection and control. Here, demands have far outrun the performance of currently available materials. This, despite the development of polystyrene, fluorocarbon and glass-film capacitor materials, irradiated polyethylene and a host of other new improved materials.

The situation is likely to get worse before it gets better. As Callinan pointed out in a paper prepared for the AIEE General Meeting, present-day equipment is designed for 185F; but "a definite urge is present to design equipment for 250 F";—and the industry is looking toward 600 F and higher.

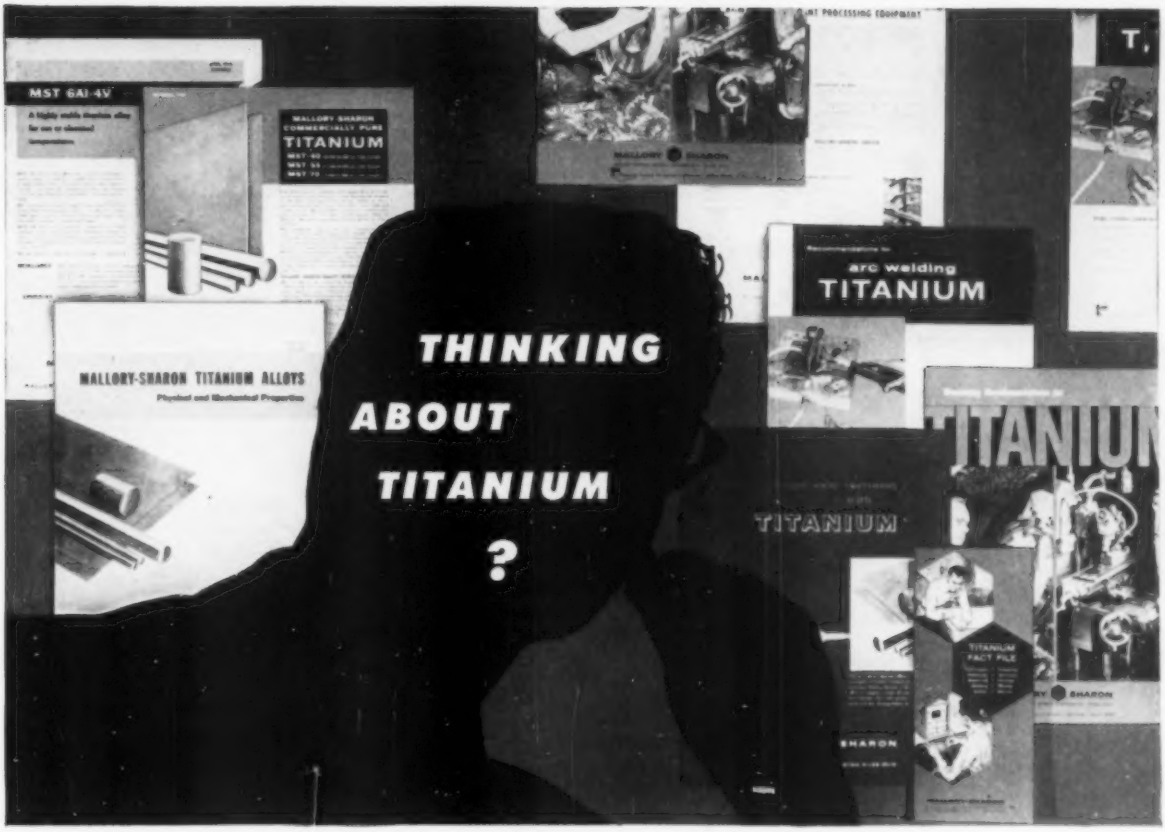
Materials worth investigating: semiconductors for capacitor use, ferroelectrics as a source of useful mechanical-dielectric effects, new heat-resistant glasses and ceramics for structural use. Also coming up: new porcelain enamel coatings (see below).

briefs . . .

Porcelain enamel coatings still offer a promising field for development as wire and stator insulation, C. G. Bergeron of the U of Illinois told the recent PEI Shop Forum.

Nothing that, with titania-opacified cover coats, it is possible to obtain an average dielectric strength of 485 v/mil, he admitted that uniformity still leaves much to be desired, and even the best electrical enamels show a marked change in dielectric properties with increasing temperature. However, he says, "their properties remain such that their usefulness as electrical insulation at elevated temperatures may still be quite satisfactory"; and, he believes, much can be done to improve present-day materials by changes in composition and application techniques. (For more on porcelain enamel see *PE*—Nov. 24, p 53.)

Quartz fibers that will stand continuous temperatures of 1800 F or more, and 3000 F for short periods, are now being produced by General Electric's Lamp Glass Dept in sizes down to 0.0005 in. dia. They can be twisted into strands and woven into cloth for plastics reinforcement, high-temperature filtration, and insulation, or put to work directly as reinforcing strands. GE is making them available in both short lengths and continuous thread. (For more on inorganic fibers and how they may be used, see *PE*—*July 7, p 84*) —ARG



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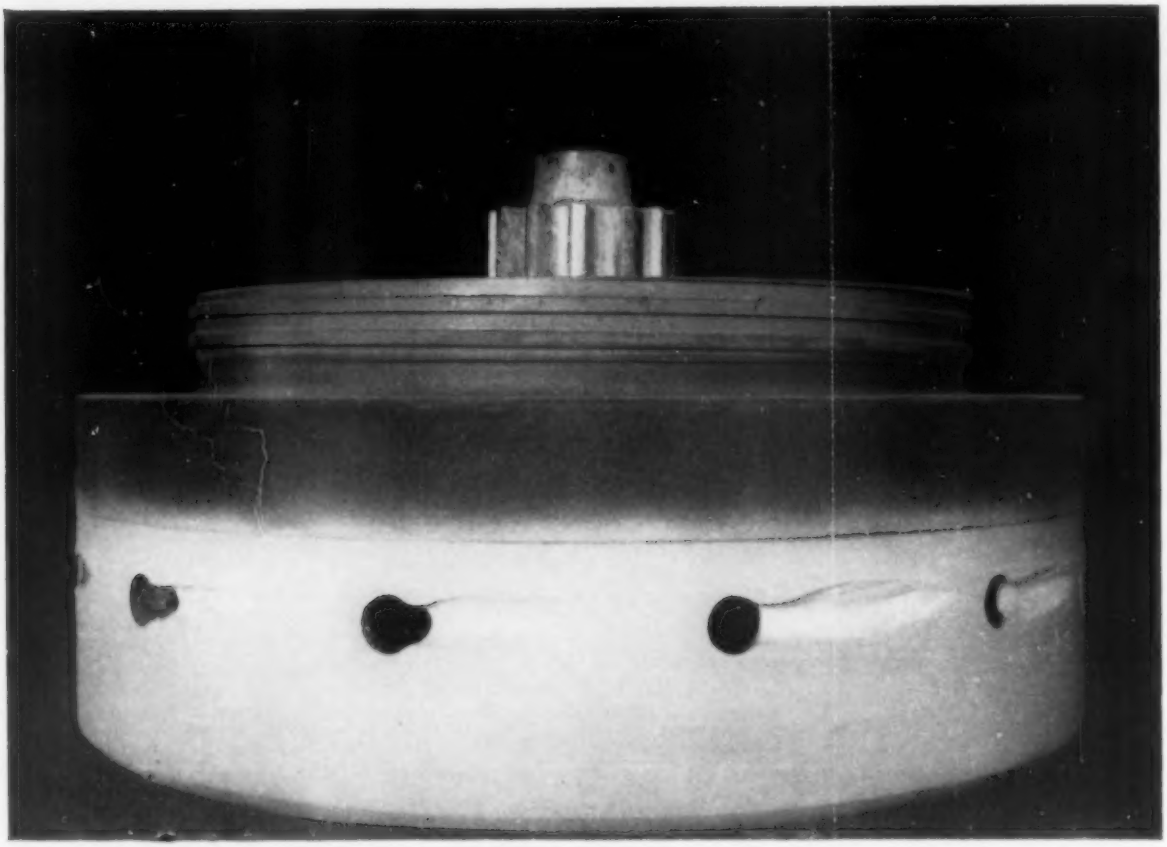

The Georgia Kaolin Company, well-known manufacturer of industrial clays, reports that they have made substantial savings by coating worn separator centrifuge bowls with Norton ROKIDE "A" coating. Worn bowls were previously returned to their manufacturer after six to eight months of high speed service for restoring to their original condition. But now Georgia Kaolin applies ROKIDE "A" coating before the bowls become badly worn . . . and at a fraction of repair cost at the factory. Service life is greatly extended. Maintenance costs and down time are substantially reduced.

How ROKIDE* Coatings increase service life, cut maintenance costs of moving parts

ROKIDE coatings are applied by heating the end of a ceramic rod and projecting the molten particles at high velocity. Reaching a prepared surface, they adhere and solidify. Protecting parts of a wide variety of sizes and shapes, these coatings are in extensive, rapidly increasing use in military and general industrial applications.

Three types of ROKIDE spray coatings — "A" aluminum oxide, "ZS" zirconium silicate and "Z" zirconium oxide — are hard, adherent, crystalline refractory materials. Parts, particularly metals, on which these coatings are especially useful are those requiring thermal or electrical insulation . . . resistance to wear or corrosion . . . excellent mechanical strength . . . dimensional stability . . . relative chemical inertness.

Possible applications: bearing surfaces, metal rolls, feed rolls, nozzles, pump shafts, thermocouple tubes and wire, mechanical seals, extrusion dies, laboratory molybdenum boats, vibratory feed hoppers, metal guides, metal melting pots, sanding fixtures, induction heating coils, strain gages, and applications in the wire industry.

Norton maintains facilities for applying ROKIDE coatings at Worcester, Mass., and at its plant 2555 Lafayette Street, Santa Clara, California. For further facts, write to NORTON COMPANY, New Products Department, 739 New Bond Street, Worcester 6, Massachusetts.

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三民主義

Let the thousands of flowers of thought bloom...

Red China thus encouraged her intellectuals to think–but it was, as is so often true in totalitarianism (ie, Pasternak), an encouragement to think . . . but. The flowers of thought must bloom in serried ranks, color by color, variety by variety, in a hothouse. Deviationism, the sport plant, is treated as ruthlessly as it is by a formal gardener.

Under these conditions, it is surprising to see that Red China has achieved something that the Nationalists could not. Sun Yat Sen complained that the Chinese were like grains of sand, endlessly flowing and blowing. They would die for family or clan, but not for country. He propounded three principles: Nationalism, Democracy, Freedom from Want. The third is being achieved, ironically, by adaptation of the Soviet principle of full employment. Everyone must work; the old people take care of the young while the middle generations go out to work; thus all have a living at least.

The first principle is being achieved by another adaptation, and a stranger one. Instead of the emphasis on building huge nationalistic enterprises, as in the USSR, the drive has been shifted to do-it-yourself production. Nowhere is this more apparent than in steel. The objective is to double production in a year–obviously mad. And the method is even madder . . . peasants, proletariat, schoolchildren, all strata of society, are setting up furnaces to make "steel" in whatever their equivalent of a backyard may be.

Thus "the great leap forward" becomes millions of tiny steps. The 18 major steel-making enterprises are being supplemented by traditional, home-made, primitive furnaces. Some of their production–from ores or scrap obtained by tearing down old buildings, equipment (even foolishly cutting up a beached Japanese warship that could have been salvaged)–results in iron that can be cast but is too high in sulfur and other impurities to be converted to steel. (East China Chemical Engineering Institute, however, claims it can make steel direct from ore with natural gas, saving 4/5 of the time and the coking coal by jumping the pig-iron stage.)

In the first half of October, when the plan really began to move, output of home furnaces rose 240%, while that of official steel plants (70% of October output) rose only 20%. In Honan, where most counties have iron ore and coal but there is no modern steel plant, output during the first half of October was four times that of all September. One day's output was 20,331 tons, greater than that of Anshan, biggest Chinese steel center. A small county in Kwangsi turned out 207,243 tons in 24 hr, using locally designed smelters–a figure almost as great as all China's production in 1949. Honan has more than 30,000 small furnaces of 20 different types, Shantung more than 61,000. Output by mid-November was 8-million tons, 50% over 1957's total.

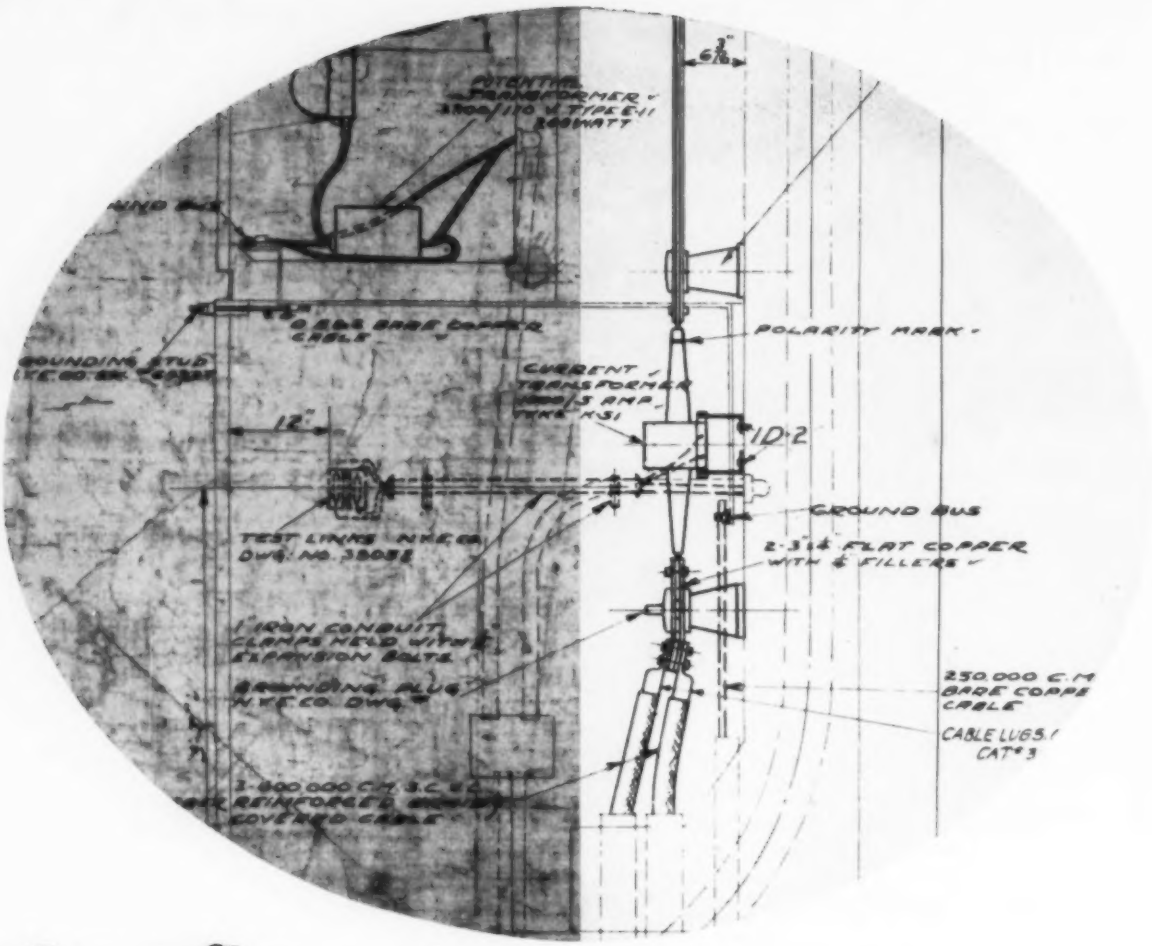
The project has spread like a disease. Students and teachers make steel after school. Karin University produced 10 tons in October, plus as much again of aluminum. A technical school built its own reverberatory furnace to use coal, coke, or even firewood; has made 20 tons of high-grade steel. About 20,000 students and teachers in physics and chemistry at universities and "middle schools" in Fukien have moved near the steel plants, to set up more than 300 furnaces and mills, do analyses and research in steel, and operate more than 500 miniature blast furnaces themselves.

This technique must be crazily inefficient. It violates all rules of method study, harking back to the sweatshop in England and the US, or the crofter industry of the Scot. But the fact remains that it is producing steel. It is not overtaxing limited transportation facilities because it works local ore or scrap to make steel for local use. It suits the method to the means.

But more than that, the campaign has at last awakened the sleeping giant, brought a sense of unity and nationalism to China, a sense of purpose. Now the USSR will have to outdo itself not only "to match and surpass the US", but also to keep her heels from under the toes of Red China.

But the third of Dr. Sun's great principles . . . democracy . . . is lacking in Red China. And this principle is the one that lets the flowers of thought really bloom.

F. J. Langerman



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THE ENGINEERING WEEK

VTOL, STOL—Planes Without Fields

- **Design of vertical, short take-off aircraft still in embryonic stage; major production five years away.**
- **Military, commercial demand for VTOL is considerable but no big budgets are provided to speed development.**

WASHINGTON—Over the past eight years, the military services have spent at least $100 million for research on vertical take-off and landing (VTOL) and short take-off and landing (STOL). Some two dozen different projects have been started. Few if any have gone beyond fabrication of research models—the "flying test beds."

Objective has been to prove feasibility of the varied VTOL-STOL flight concepts. Designers say they are now at the stage where they're ready to start wide-scale flight testing. But there has been criticism that the military services have spread themselves too thin on VTOL-STOL research, that efforts should be concentrated on fewer types of experimental planes. In explanation, John P. Campbell, NASA research planner, says, "The present approach was chosen for the express purpose of providing a limited amount of information on a large number of configurations in a short time in order to determine at an early date the proper direction for our major VTOL-STOL efforts.

Although a handful of experimental models have flown—the Bell X-14 deflected jet, Vertol model 76 tilt-wing, and Piasecki aerial jeep, for instance—the military says tests have been inadequate to demonstrate the superiority of one type over another.

Still, they believe the general feasibility of VTOL-STOL flight has already been demonstrated. Within the next five years, they're hopeful of seeing the completion of flight test evaluations, the manufacture of prototype planes with significant engineering changes from the experimental models, then production models.

To VTOL-STOL boosters, the planes have a great potential for both military and commercial purposes. As military aircraft, the VTOL and STOL vehicles will have initial missions for observation, close tactical support, rescue, and transportation.

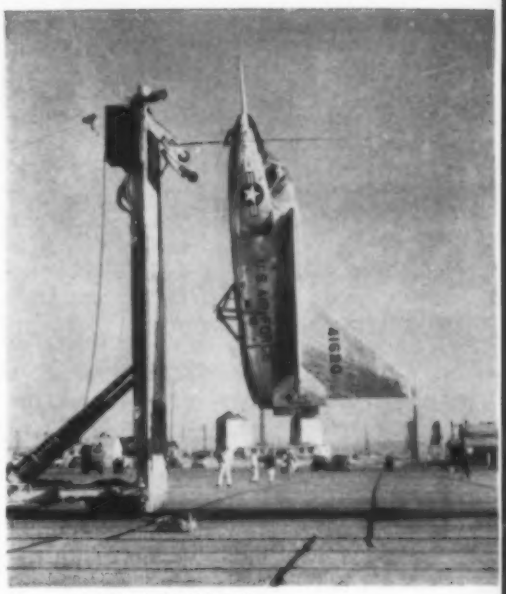
Commercial transportation prospects are centered on economic considerations. But VTOL-STOL designers claim there is no penalty in terms of weight for vertical take-offs and landings. Indeed, they say that the penalty is less for VTOL than for more conventional transport planes as higher speeds are developed.

The first civilian potential appears to be in the field of short-range mass transportation—the "feeder" airlines. British Overseas Airways Corp maintains it is now ready to begin service between downtown London and downtown Paris with Fairey Aviation's Rotodyne, a $309,000 craft that will carry 48 passengers flying at speeds of 185 mph. This is an unloaded rotor convertiplane with pressure jets driving the rotors.

Current US military expenditures on VTOL-STOL aircraft research run at about $15 million a year. The Army is the biggest spender. But both the Air Force and Navy also sponsor work in this field. The outlook is for only slight increases in the next two years. Heavier expenditures will be made only after flight tests.

The Pentagon says military budget economies have not seriously affected the program so far. Says one official: "Sure, if we had unlimited funds we could always use it. But we're going as fast as technology will allow."

The military program is coordinated by a joint Pentagon committee headed by officials from the aeronautics branch in the office of the Asst Secy of Defense for Research and Engineering. The three services and the National Aeronautics & Space Administration are represented on the committee. Result: the varied VTOL-STOL research planes will undergo comparable flight testing.



USAF's X-13 Vertijet

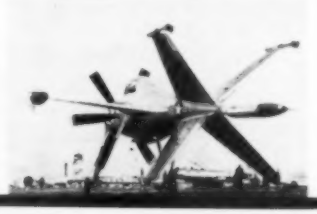
HOW THEY LOOK

VTOL-STOL experimental aircraft are classified on the basis of (1) propulsive means for hovering and low-speed flight—rotor, propeller, ducted fan, and turbojet; and (2) the means of accomplishing the transition or conversion from hovering to forward flight—dual propulsion, thrust redirection, and aircraft tilting.

Examples of dual propulsion rotor VTOL planes are McDonnell's XV-1 unloaded-rotor convertiplane and Sikorsky's stowed-rotor convertiplane, sponsored by the Army and administered by the Air Force. The SV-1 project has been terminated, but McDonnell is now studying the use of turbopowered, multipropeller models instead of the reciprocating engine with a pusher propeller used in the first vehicle.

Both Bell and Transcendental Aircraft have built and flown tilting-rotor convertiplanes. Kellett Aircraft designed a thrust-tilting type convertiplane which was never built. Bell's XV-3 features combination rotor-props mounted near the tips of a

Army's airborne jeep (Piasecki) Navy's Lockheed XFV-1 VTOL fighter USAF's Bell jet-propelled X-14 USAF's Hiller X-18 tilt-wing craft



stubby fixed wing, acting as helicopter rotors for takeoffs and landings, then tilting forward to perform as conventional props for cruising.

Kaman Aircraft has been studying a rotor-type VTOL using the deflected slipstream principle in combination with either a partially tilting wing or partial aircraft tilting.

Vertol's model 76 for the Army and Hiller's X-18 for the Air Force are thrust-tilting propeller types. On the Vertol plane, a single turbo-prop engine is geared to two rotor-props mounted on the wings that can set in a vertical or horizontal position.

Ryan's model 92 vertiplane is a thrust-deflection type—the slipstream deflection for hovering and low-speed flight is accomplished by a large-chord, two-segment flap on a high wing with underslung nacelles. For hovering flight, a swiveling turbine exhaust nozzle at the tail provides pitch and yaw control. Tests to study transition from hovering to forward flight are now underway.

Convair's XFY-1 and Lockheed's XFV-1 are examples of propeller-driven configurations of the aircraft tilting type. Vertol is doing research on a dual-propulsion type ducted-fan model called Vertodyne, which has shaft-driven ducted fans submerged in the wing with provision for covering the ducts in forward flight. Ryan has designed a "vertifan" configuration which uses a ducted fan driven by turbine blades on the fan periphery rather than by shafting as in the Vertol.

Doak Aircraft, Bell Aircraft, and Hiller helicopters are pushing tilting ducted-fan VTOL aircraft. Piasecki, Goodyear Aircraft and Collins radio are working on thrust-deflection type ducted fans.

Some experts say Ryan's X-13 is the most impressive VTOL plane flown in the US (p. 17). This jet tailsitter hangs bat-like from a nose hook and cable arrangement for takeoff and landing.

Pitch and yaw control in hovering flight is provided by swiveling the tail pipe while roll control stems from wing-tip nozzles. An elaborate automatic stabilization system furnishes stability in all flight conditions.

Army-USAF's Bell XV-3 Convertiplane

The Secret Saucer

TORONTO—Of all the vertical rising craft under development, perhaps the one most shrouded in secrecy is the "flying saucer" being developed by Avro Aircraft Ltd of Canada for the US Air Force.

According to reports, the saucer is from 30 to 50 ft in dia; and is powered by from three to six jet engines located around the periphery of the saucer. The control, or observation dome in the center remains stationary while most, or all of the rest of the machine revolves at high speed. The thrust of the engine is deflected downwards by adjustable vanes which lift the saucer vertically. The vanes then change direction at right angles, somewhat like the helicopter changing the pitch of its rotors.

It has been reported also that the saucer is plagued by many machining problems caused by metals having to endure widely varying temperatures. And, that the saucer's flight has been delayed by the intervention of various "defense authorities" who want to see it fitted with the full range of electronic devices. According to one who had seen an early version, the craft was extremely simple. "It didn't even have an hydraulic system."

During development of prototype models, three engines were used at one stage, five at another. Apparently a free flight model was built and flew on compressed air.

Descriptions of the saucer have varied. One described the saucer as a meat sandwich with the vanes as the meat and the two sides of the saucer making up the bread position.

Pulse-counting Comparator Controls Table Movement to 0.00025 in.

LOS ANGELES—A tape-controlled digital-to-analog converter that gives angular rotation exactly proportional to the number of pulses received, to produce a machine-tool table movement of about 0.00025 in, has been developed by the Micro-Path Div of Topp Industries. Called the Pulservo power unit, it is part of the company's low-cost system for automating machine tools and may be adapted to the control of special or old machine tools, or new tools still in the design stage.

This pulse-counting positioning comparator combines a low-power stepping motor and a linear differential transformer. The stepping motor has 8 polar coils pulsed in opposite pairs, with a toothed rotor that moves 1/40th of a revolution for each pulse. The rotor locks into position until the next advance pulse is received.

The stepping motor turns a lead screw attached to the core of a linear differential transformer, which is part of a null-balance circuit that powers the drive motor to rotate the transformer until it returns to the zero position. Micro-Path says that the transformer eliminates problems caused by loading stepping motors, and permits the system to store pulses until it returns to balance. One pulse equals 5° of shaft rotation which would produce about 0.00025 in. of table movement with a conventional feed, at a max rate of 50 in. per min.

The information storage system is a ¾-in. tape with 11 channels: 4 for each direction (one axis at a time with a total of 8); one stops the table or other internal function; one controls quill or other external function, one rewinds tape, or command function. Tape speed 24 ips; 175 pulses per in.

When a safety-check is programmed into the tape, it moves the table to a point that would give a zero reading on the dial (leadscrew-connected). Built into the dial is a solenoid-actuated "feeler" that lifts a pin toward the inner rim of the dial itself. Another wedge-shaped pin has been press-fit into the dial at the zero point. Under ideal conditions, these two engage and the lifted pin can't be budged. If the lifted pin isn't stopped (because the machine has lost a pulse, or for some other reason is not where it should be), a precision switch is closed, an "error" light on the control panel lights up, and the operator has to see what's wrong and manually-reset before continuing.

USSR Reaches Production Goals; Doubled Capital Output Seen by 1965

Moscow—Premier Khrushchev has told the Soviet people to double the output of machine tools, metalworking equipment, and instrumentation for automatic production lines by 1965. Such expansion of capital equipment industries is part of an economic development plan to raise the nation's industrial production 80% in the seven-year period. Some sample production targets in the capital goods area are:

Metal-cutting lathes: 190,000 to 200,000 units—a production gain of 50% over 1958.

Forging and pressing machines: 36,200 units—this is a 50% gain over 1958.

Automatic and semi-automatic lines: 250 to 271—double the number of such lines this year.

Instruments: 18.5 to 19.2 billion rubles—2½ times 1958 production.

Computing and mathematical machines: 2 to 2½ billion rubles—4½ to 5 times this year's production.

Turbines: 18.7 to 20.4 million kilowatts—3 times 1958 production.

Generators for turbines: 17.5 to 18.4 million kw—3 times 1958 production.

AC electric motors: 32 to 34 million kw—more than double 1958 output.

Rolling-mill equipment: 200 to 220 tons output—about double this year's output.

Chemical equipment: 3.5 to 3.7 billion rubles—about 3½ times current output.

Textile industry equipment: 2½ billion rubles—double 1958 production.

Food industries equipment: 3.8 to 4.1 billion rubles—2½ times 1958 output.

Motor vehicles: 750,000 to 856,000 units—1½ times this year's output.

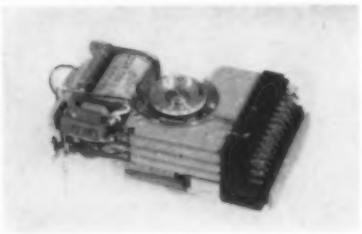
Electric and diesel locomotives for trunk lines: 2550 to 2700 units—a gain of 2½ times over 1958 output.

Equipment for cement industries: 180 to 220 thousand tons—2½ times this year.

Equipment for foundry production: 360 to 410 million rubles—double this year's output.

Khrushchev also called for expansion of consumer goods industries. For the Soviet citizen there will be more washing machines, refrigerators, dishwashers, radios, radio-phonographs, TV sets, watches, cameras, bicycles and motor scooters. Output of household appliances is expected to double, amounting to about 88 billion rubles in 1965.

Continued expansion of consumer and industrial production facilities, Khrushchev asserted, will depend upon rapid development of many branches of science. Hence, he said, extensive programs in scientific research are being formulated and funds have been set aside for additional labs with up-to-date equipment. Scientific programs will emphasize physics, particularly problems associated with cosmic rays, nuclear reactions, and semiconductors.



Midget rotary selector switch . . . developed by Siemens Edison Swan Ltd., London, steps 60 a sec through 36 stations. Overall dimensions are only 3¾ x 2 3/13 x 1 5/32 in; and weight is 12 oz; operating voltages are 22 or 50 v. All circuits terminate in a bank of contact blades mating with a socket permitting removal of the unit without rewiring.

NASA Sets Technical Committees

Washington—The National Aeronautics and Space Administration is putting its organizational structure and staff into shape. T. Keith Glennan, Administrator, has announced formation of 13 research advisory committees to give NASA technical counsel and a special committee on the life sciences to advise on human problems in space.

The technical committees, expected to begin functioning early next year, will review, recommend and coordinate programs in the fields of fluid mechanics; aircraft aerodynamics; missile

(CONTINUED ON PAGE 22)

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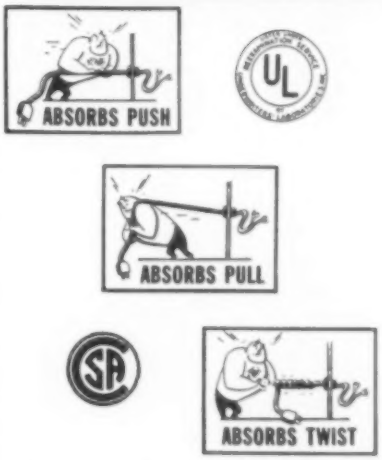

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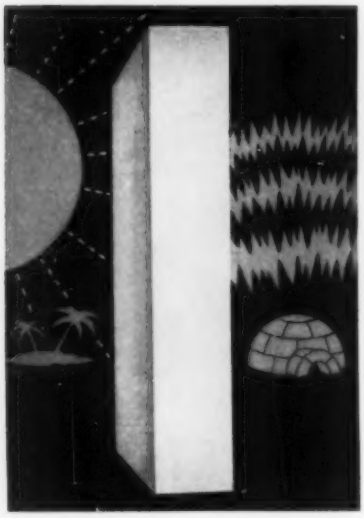

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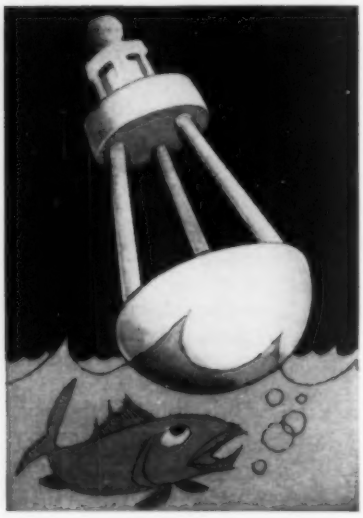
The Thermal Conductivity (K Factor) of DYLITE is 0.242 at a 75°F. mean temperature at 2 lb./cu. ft. density. DYLITE is highly resistant to the passage of heat and is unaffected by moisture condensate. DYLITE is easily molded to fit the contours of component parts of refrigerators, air conditioners and freezer cabinets.

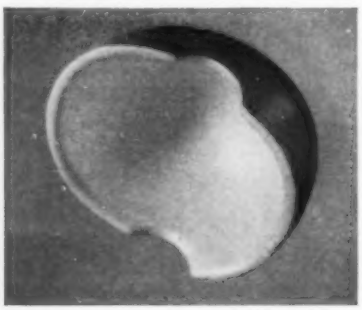


DYLITE
IS WATERPROOF

At 2 lb./cu. ft. density, DYLITE's rate of Water Vapor Transmission is 1.18 perms., and its rate of Water Absorption is 0.54 lbs./cu. ft. after 48 hrs. immersion. DYLITE is ideal for boats, rafts, buoys and other types of buoyant marine equipment. DYLITE remains in the water indefinitely without becoming waterlogged, and it is mildew-proof.

DYLITE
IS SHOCK-RESISTANT

DYLITE possesses an Energy Absorption ratio (Maximum Load) of 56.74 in. lbs./cu. in. at a density of 2 lb./cu. ft. For example, police safety helmets with shock-absorbent DYLITE liners are now used extensively—a result of performance tests in which DYLITE was proved superior to other materials for this job.



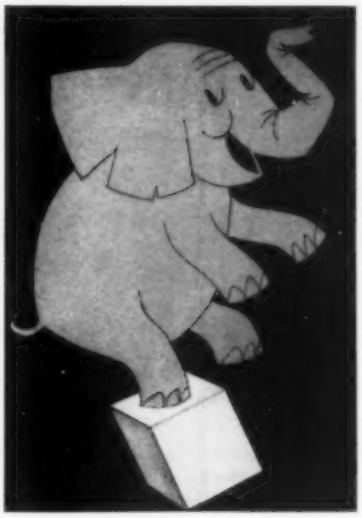
Typical Properties of DYLITE—Density 2 Lb./Cu. Ft.

- Compressive Strength—30 Psi
- Tensile Strength—55 Psi
- Water Vapor Transmission—1.18 Perms.
- Water Absorption—0.54 Lbs./Cu. Ft. After 48 Hrs. Immersion
- Thermal Conductivity (K Factor)—0.242 at a 75°F. Mean Temperature
- Energy Absorption (Maximum Load)—56.74 In. Lbs./Cu. In.

DYLITE is a registered trademark of Koppers Company, Inc.

DYLITE

TO YOUR DESIGN PROBLEMS

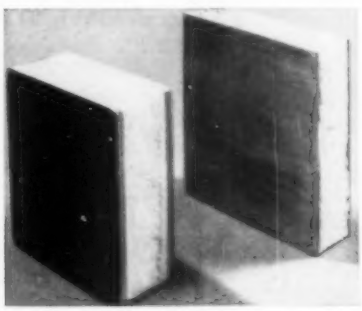


DYLITE IS LIGHTWEIGHT

DYLITE is lighter than cork—it can be molded in densities of 1 to 10 lb./cu. ft. The advantages of light weight are obvious. In packaging, DYLITE helps reduce shipping costs and makes handling easier. In the construction field, where DYLITE is used as an insulator, its light weight means fast and easy installation.

DYLITE IS STRONG

DYLITE has a Compressive Strength of 30 psi and a Tensile Strength of 55 psi at a 2 lb./cu. ft. density. DYLITE can be used to great advantage in a wide variety of industrial design problems. For instance, sandwich structures that employ DYLITE as the core material offer high strength without sacrificing light weight.



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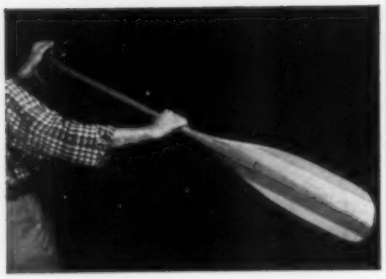

Gamble research even improves *BOAT PADDLES!*

THE PROBLEM: The armed forces' solid wood life raft paddles often shattered when dropped from a plane, or splintered when used to "pry" a landing craft onto a beach.

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and spacecraft aerodynamics; nuclear energy processes; mechanical powerplant systems; electrical powerplant systems; chemical energy processes; control, guidance and navigation; structural loads; structural design; structural dynamics; materials; and aircraft operating problems. They supersede the 28 technical committees and subcommittees of the absorbed National Advisory Committee for Aeronautics.

Dr. Randolph Lovelace II, Director of Lovelace Foundation for Medical Education and Research, Albuquerque, NM., will head the new life sciences committee.

Ordnance People Hear Pleas for Informal R&D

NEW YORK—Advanced development programs that have no definite goal can lead to important achievements that will enable us to surpass the USSR technically. This theme was expressed in various guises by speakers at the annual American Ordnance Assoc. meeting here.

Association members — executives, engineers, scientists and other citizens concerned with a mobilized defense industry—heard frequent appeals for more support of speculative applied research, exploratory development, and state-of-the-art work. Such programs would lead not to hardware designed for a specific system, serving a clearly defined military need, but to hardware built to learn what can be done. The components that result may fit, with modification, into many systems. They could also provide technical wealth to back up crash programs required by changing military, political or economic needs.

"Initiation of much applied research and component development is delayed until some specific system is funded," A. H. Flax of Cornell Aeronautical Labs warned the group. "But, often we have done the right applied research without really knowing why we were doing it. For example, the Navaho missile program, now defunct, provided important applied research, often of a more or less general nature, in the fields of large liquid rockets, inertial and other forms of guidance, and supersonic aerodynamics. The work has been of the greatest importance to many current programs, particularly

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the ballistic missile programs now on a "crash" basis. It is expecting too much to hope that even the best-planned program will always do all the correct applied research. In this activity we are highly deficient and seem likely to become more so."

By failing to take account of the "state of the art," and by not providing adequate research funds to advance it, we are increasing time and cost of research, Rear Admiral John T. Hayward, Assistant Chief Naval Operations for Research and Development, asserted. Worse still, he added, we often wind up with an undesirable end product.

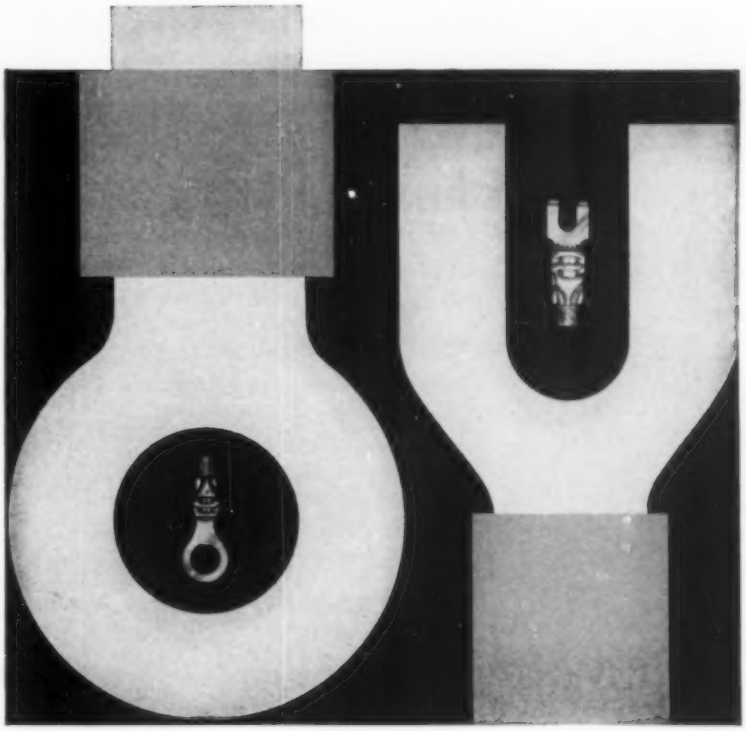
"There are many systems," Admiral Hayward pointed out, "that have only been systems on paper. We have a terrible tendency to get wed to this system concept and forget the fact that one cannot put together a system unless the components exist. It is not possible to invent on schedule as we have so often tried in the past on some of our big programs."

Admiral Hayward asserted further that parallel investigation is not necessarily bad. Duplication of research is bad but often different groups working in the same area will pursue alternative paths. Their combined efforts add more to technical wealth than does a single highly organized approach.

New Satellite Program Scheduled

WASHINGTON—The Pentagon has announced a new space satellite program, "Project Discoverer." It will be managed by the Air Force, under direction of the Defense Dept's Advanced Research Projects Agency, and will run indefinitely at a cost of several hundred millions. Purpose is to experiment with reentry and recapture techniques, and to test military space hardware such as guidance systems, satellite stabilization gear, infrared warning satellites, and assorted vehicles. Ultimate goals: to launch operational reconnaissance satellites and manned space craft.

At least 12 experimental satellite launchings are planned over the next year. First try will come within the next couple of months at Vandenberg AFB, Cal, with an attempt to orbit a 1300-lb satellite. The first Discoverer



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vehicle will be a Douglas Thor IRBM as first stage, and a new Lockheed rocket vehicle, powered by a Bell Hustler liquid-propellant rocket, as the second stage. Later Discoverer satellites will be launched by other ballistic missile and rocket combinations.

ARMY STILL GETS FUNDS FROM NASA

Meantime, the much-ballyhooed struggle for bureaucratic control over the Army's rocket and space research centers has been settled for the time being. The Army's Jet Propulsion Labs, Pasadena, Cal, is being transferred to the new National Aeronautics & Space Administration.

A compromise, however, has been made on the renowned labs of the Army Ballistic Missile Agency, Huntsville, Ala, where Dr. Von Braun and his team of ex-German scientists hold forth. ABMA will remain an Army installation and will not be turned over to NASA. On the surface this looks like an Army triumph. But the triumph may turn out to be a hollow one; ABMA will be dependent on civilian NASA for major project assignments and funds.

UHF Transistor to be Commercially Produced

DALLAS, TEX.—Commercial production of the 2N559 ultra high frequency diffused-base "Mesa" germanium transistor for advanced military and commercial applications has been announced by Texas Instruments Inc. TI says this transistor represents the most significant advance in commercial semiconductor technology since the development of the diffusion technique.

This transistor type was originally developed and produced by Bell Telephone Labs for high reliability operation in exacting military missile and airborne electronic circuits. TI claims the new TI 2N559 exceeds reliability specifications in MIL-T-19500A. Switching speeds in the millimicrosecond range and a typical alpha cutoff frequency of 250 megacycles suit the TI 2N559 for ultra high speed switching applications. It is rated to dissipate over 150 milliwatts in free air, and will operate at 100 C.

The new TI 2N559 is available in a miniature round-welded case less than half the size of the standard JETEC-outline to-5 unit. The case is compatible with the 100-MIL grid mounting system.

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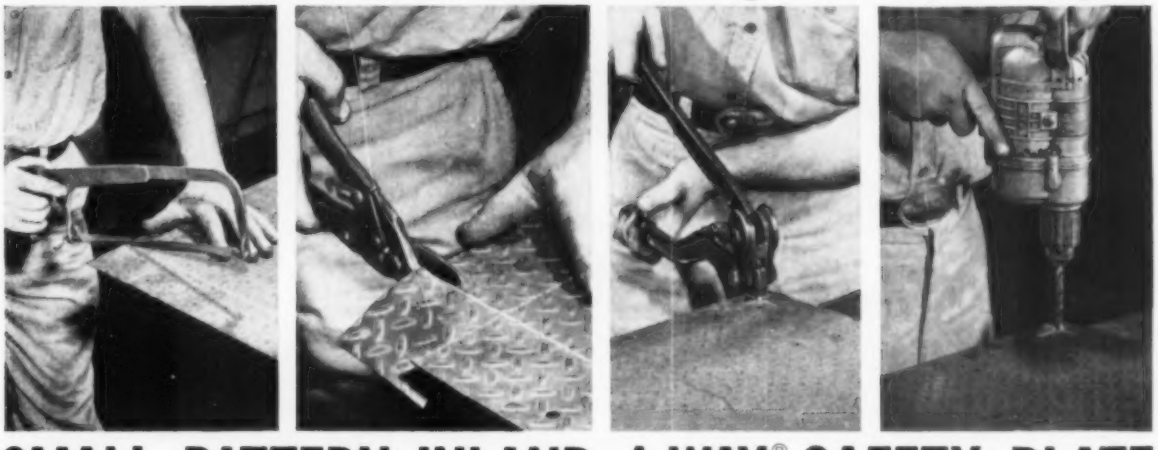

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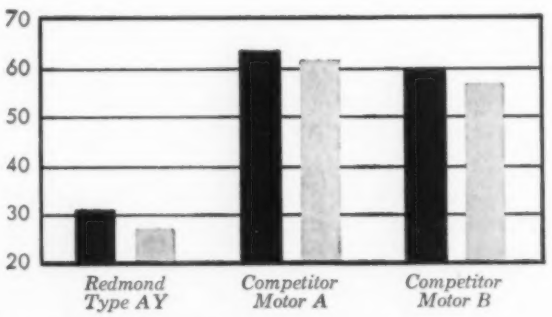
New Redmond Design Reduces Blower Vibration to One-Fifth that of units using Conventional Shaded-Pole Motors

Apply vibration tests and you will be quick to agree that here is the quietest direct-drive blower motor available. The AY Tri-Flux motor is designed and manufactured in every way to give years of trouble-free service and whisper-quiet operation. The positive oil system provides force-feed lubrication. Recirculating the oil assures maximum bearing life.

The graph shows vibration test results on the new Redmond design and two competitive motors. These tests were made with the best vibration testi ıg equipment available. The solid black bar shows vibration on the motor end cap; the gray bar shows vibration on the blower housing. The graph is decibel readings on 120 cycles, since the 120 cycle frequency is the one that is the basic source of nearly all noise problems. Reduction of vibration is a logarithmic function—the reduction of vibration in the Redmond motor to 33 decibels reduces noise to only 1/5th that of conventional motors.

The new AY is ideal for a wide variety of applications requiring a whisper-quiet, economical, high-quality motor. Contact us at Owosso, Michigan, and we will have the Redmond sales engineer in your district call you at once.



The Standard of Dependability

CC Redmond COMPANY, INC.

Subsidiary of CONTROLS COMPANY OF AMERICA

OWOSSO, MICHIGAN

REDMOND

FOREIGN PATENTS—

NUISANCES OR NUGGETS?

Millions of dollars are spent every year by American inventors and corporations in seeking and maintaining foreign patents. Yet few of these patents are ever converted into profits. This review of the pitfalls and potentials will help you convert more foreign patents into profits.

WORTH WADE *Manager, Patent Development*
American Viscose Corp

The author here discusses the future of disposable garments. A registered patent attorney and chemist, Dr. Wade has had more than 25 years of experience in patent licensing. He is the author of *Patents for Technical Personnel* (1951) and *Patents for Technical Students* (in preparation). He has lectured at the Practising Law Institute of New York and before the AMA. Dr. Wade has been president of the American section of Societe de Chemie Industrielle and a member of the Patent Committee of the NAM.

Why get a foreign patent? There are several reasons: To provide a basis for protected manufacture in a foreign country; to provide income by licensing or selling foreign patent rights; and to create patent rights which can be traded or exchanged for patent rights owned by aliens in the US.

To succeed in foreign licensing, it is necessary to follow these steps and preferably in this order:

- Fit the product to the market.
- Determine the short- and long-term market potential.
- Compare competitive products with your product.
- Build up the patent protection.
- Determine government policy and currency restrictions.
- Select the proper prospect.

Which inventions should be protected

Because the cost of filing, prosecuting, issuing and maintaining patents in foreign countries can be so high, it is advisable to be very selective when filing abroad. Even the invention commercially successful in the US can fail in countries where there is a lack of raw materials or where it runs counter to social customs.

A successful invention relating to throw-away paper drinking cups will fail in most European countries where paper is expensive. An invention relating to a cotton fabric need not be filed in Egypt (which raises cotton) but only in those countries that manufacture cotton fabrics such as Canada, England, France, Italy and Germany, none of which raise cotton. Inventions relating to outdoor movies, drive-in banking and self-service supermarkets are likely to fail abroad because these facilities are not available in most foreign countries.

The foreign market survey

A special report "Researching Foreign Markets," published by the National Industrial Conference Board Inc. 460 Park Ave, NY 22, describes sources and methods of collecting foreign market information.

Check the publications of the World Trade Information Service of the US Bureau of Foreign Commerce. This bureau publishes economic, operations and statistical reports of which the most useful are the economic reports. They include basic economics data, reports of recent economic developments, how to establish foreign business, and patent and trademark regulations of a particular foreign country.

For certain countries such as Sweden and France, the bureau has combined market studies under a single title such as "Doing Business in Sweden." See also the bureau's *Investment Handbook* series which includes reports like "Investment in Australia." More than 17 countries have been covered in these individual reports.

Other publications of the Bureau of Foreign Commerce which may be useful: *Foreign Commerce Weekly*, "*World Trade Directory*," "*A Directory of Foreign Development Organizations for Trade and Investment*," "*A Guide to Foreign Business Directories*."

Other helpful publications are those of the Unesco Division of the United Nations. For Europe you should also consult the quarterly publication of the Organisation

for European Economic Cooperation (European Common Market), which covers the productivity of the major European countries.

Judging the competitive situation

Now you know if the product is suitable for the foreign market and the market potential. Next determine whether the product is competitive with similar products in the particular foreign country. It is frequently possible to obtain free samples by writing to the principal producers in a foreign country. Names and addresses of competing firms can be obtained from the *World Trade Directory* published by the Bureau of Foreign Commerce. Foreign products should be tested against the product to be licensed, and production costs estimated from the nature of the raw materials and manufacturing methods to be used.

Providing patent protection

Foreign patents may not be filed until six months after the US filing date unless a license is first obtained from the Commissioner of Patents who may place a stop-order against foreign filing within six months. The application may be filed without a license if there is no stop-order.

Many countries permit applicants to combine two or more US patent applications if they relate to the same subject matter, and if they are filed within one year of each other. This helps reduce the cost of foreign filing.

Government regulations regarding licensing in any particular foreign country and currency restrictions, if any, may be obtained from consulates of the foreign country and also from the foreign departments of our large commercial banks. In many countries no patent license agreement is effective until it has been approved by one or more government agencies. The convertibility of foreign funds into United States dollars for the payment of "know-how" fees and patent royalties are also subject to approval.

The foreign prospect

One of the most difficult steps in foreign licensing is selecting the right prospect. Inventors are advised to employ a foreign agent to assist them in selecting and negotiating foreign license agreements. A list of legal and business consultant firms that perform these functions is published by the Commercial Intelligence Division of the Bureau of Foreign Commerce.

It is not always best to select the leader in a particular industry. The leader usually makes the highest quality product and has the best research and development staffs. The second, third or fourth largest company in a foreign country is often more receptive to new products.

Finally there is one cardinal rule which should always be followed: *Never attempt to exploit a product in a foreign country until it has reached the commercial stage in this country.* Foreign firms usually have small research and development budgets and they are not interested in buying research problems.

To negotiate the foreign license

After the prospect has been selected the patent owner sends him samples, general technical data, market potential, cost estimates and patent information. It is very difficult to negotiate any license agreement by mail. If the inventor

INTERNATIONAL TREATIES RELATING TO PATENTS

Patents are effective only within the territory of the country granting the patent. The major nations of the world have, from time to time, entered into treaties relating to reciprocal patent rights. The chief treaties on patents now in effect between the United States and foreign countries are the following:

International Convention for the Protection of Industrial Property (patents), signed at Paris, March 20, 1883 and ratified by the US on May 30, 1887. Member countries are listed on the facing page. In general the Convention provides that when a patent application is filed initially in any member country, it can be filed within one year thereof in one or all of the other member countries, and each such foreign application will have priority from the date of initial filing.

For example, an inventor files first in the US on Dec 10, 1956, but he does not file in Great Britain until Nov 9, 1957, in France on Dec 2, 1957 and in Italy on Dec 9, 1957. He still retains priority for each of these foreign patents from the date of his filing in the US, that is, from Dec 10, 1956.

Thus, under this Convention, an inventor or applicant has a period of one year in which to judge whether the invention is sufficiently valuable to justify the expense of filing abroad, and it also protects him from loss of rights to foreigners who may have learned of his invention after his first filing date.

After the expiration of the one-year period, an inventor or owner may still file an application for patent in foreign countries provided he can meet the requirements for filing, but he loses the priority date and must depend solely upon the filing date in each foreign country.

Treaty of Brussels, 1900. This agreement amended the International Convention to provide that patents issuing in the different member countries shall be independent of each other and that their terms shall be determined by the law of the country which grants the patent.

Treaty of the Hague, 1923. This treaty amended the International Convention to state that priority shall be limited to the date of first filing of the invention in any member country.

Treaty with Great Britain on communicated inventions, 1942. To promote cooperation in the war effort, the US and Great Britain made an agreement on Aug 24, 1942, under which disclosures of inventions were made on a reciprocal basis with the understanding that such disclosures or use of the invention in either country would not bar the inventor from the right to obtain a patent in either country.

Peace treaties involving patents. To prevent loss of inventor's rights because of delays caused by war, peace treaties frequently provide additional time for inventors to file or to prosecute their pending patent applications. After World War I the Treaty of Versailles extended the time for 6 months, and after World War II the Boykin Act of Aug 8, 1946 extended the time for filing and prosecuting a pending patent application in foreign countries where reciprocal rights were granted to US inventors.

SPECIAL FEATURES OF FOREIGN PATENTS

Most of the civilized countries of the world have patent systems.

Differences: When an inventor is granted a US patent he is not required to use it or to permit others to use it; he does not have to pay a tax to maintain his patent; and he is not compelled to grant licenses to other, unless he misuses his patent. But in most foreign countries a patent owner has many of these obligations.

Who may apply. In the US only the *inventor* may apply for a patent, but in most foreign countries an assignee may apply in his own name. In most countries proof of assignment has to be furnished.

Examination for novelty. In a number of countries such as Great Britain, Germany, Holland and Japan, there is a thorough examination of the invention as to novelty and patentability, just as in the US. In most other countries there is little or no examination and the validity of the granted patent is left for the courts to determine.

Opposition to grant. In some countries, such as Great Britain and Germany, the patent application is published and the public is allowed a limited time in which to oppose the grant of the patent on the ground that it is not patentable over the prior art, or is impracticable, or anticipated by prior use within the country. The applicant has the right to respond to the opposition. The final decision rests with the patent office.

Taxes. In the US and Canada no taxes are required to maintain a patent in force. In many foreign countries a tax or annuity fee must be paid annually to maintain the patent; and if the tax is not paid when due, the patent is considered abandoned.

Working. In the US and Canada an inventor or owner need not use a patent, but in many foreign countries the patent must be "worked" within a specified period of time after the grant. Working may be effected, in some cases, by actual manufacture under the patent; by advertising for licensees; or by payment of a fee in lieu of actual working. Failure to work the patent may result in abandonment, or the owner may be compelled to grant a license to another party if patent protection is not to be lost.

Members of the International Patent Convention

- Austria
- Belgium
- Brazil
- Bulgaria
- Canada
- Ceylon
- Cuba
- Czechoslovakia
- Denmark
- Dominican Republic
- Dutch Antilles
- Dutch New Guinea
- Egypt
- Finland
- France (including Algeria and colonies)
- Germany
- Great Britain and N. Ireland
- Greece
- Holland
- Hungary
- Indonesia
- Ireland
- Israel
- Italy
- Japan
- Lebanon
- Lichtenstein
- Luxembourg
- Mexico
- Monaco
- Morocco
- New Zealand
- Norway
- Poland
- Portugal (including Azores and Madeira)
- Roumania
- Singapore
- Spain
- Surinam
- Sweden
- Switzerland
- Syria
- Tanganyika
- Tangier
- Trinidad and Tobago
- Tunisia
- Turkey
- Union of South Africa
- United States
- Vietnam
- Yugoslavia

Of the nonmembers, the most important countries are Argentina, Red China, Eastern Germany, India, Pakistan and Russia.

or patent owner is not able to visit the foreign country, he should endeavor to have the foreign company send representatives to the US. The only alternative to this procedure is to use the services of a foreign agent. For this a commission has to be paid, usually from 5% to 15% of the consideration.

To be certain that no important provisions of the agreement are overlooked, one should use a Foreign Patent License Checklist such as that published by Advance House Inc, Ardmore, Penna. If there is any substantial know-how, a separate consideration should be charged for it, in addition to the patent royalty.

Great care should be taken to avoid provisions which are in restraint of trade such as territorial limitations on the sale of the product produced under the license. Remember that agreements between US citizens and aliens are subject to all the US laws on restrictive trade practices, such as the Sherman Act, Clayton Act, Robinson Patent Act and the regulations of the Federal Trade Commission. Violation of the antitrust laws will subject the patent owner to various penalties including forfeiture of the patent or compulsory licensing.

The European Common Market

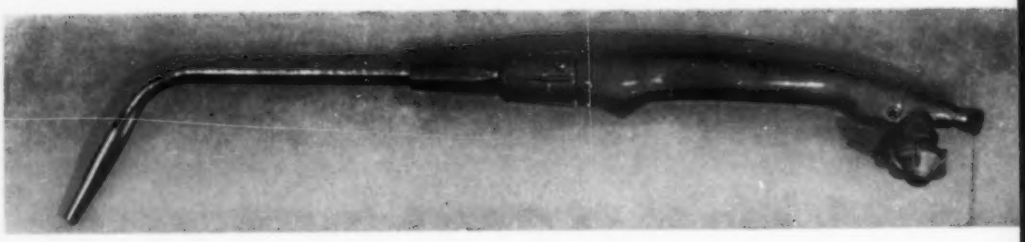
The European Economic Community consists of six countries: West Germany, the Netherlands, Belgium, Luxembourg, France and Italy. The chief objective of this economic union is to gradually reduce tariffs between the member countries while maintaining tariffs against nonmembers. From 12 to 15 years will be required before all tariffs have been abolished on all commodities.

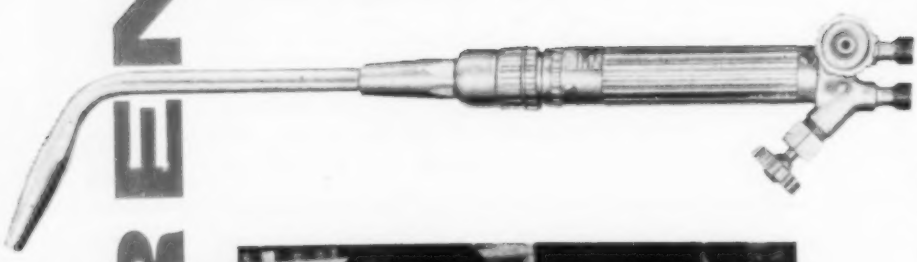
It is already apparent that this economic union will have a strong effect in world markets. Small companies have merged and the lowest grades of many products are being discontinued in the face of competition.

There is a tendency for foreign prospects to request a license for all six countries. Accordingly, it is necessary for the patent owner, when selecting the prospective licensee, to pick the best prospect in the whole economic union. Further, there is a tendency for the licensee to request the right to sub-license. In many cases the patent owner would be wise to insist that a limited number of sub-licenses be granted to promote the widest use of the invention.

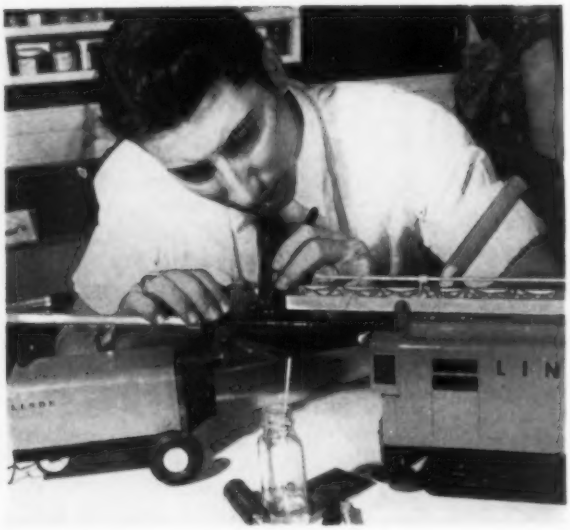
When it was possible to grant separate licenses for each of the major countries, the total consideration received from the several licenses was potentially greater than the amount that can now be obtained from a single license covering the whole union territory. But it still is possible to convert foreign patents into profits by following the steps set forth. ■

TRENDS in appearance design...

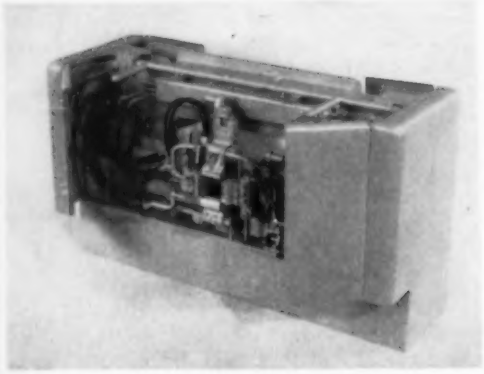




Traditional cylindrical shape (at left) of blowpipe handle for oxyactylene welding and cutting required tight grip. New handle (above) needs only loose, relaxed grasp—even with gloves. Lump at forward end of grip makes it as easy to hold during overhead welding. Curvature follows natural bend in supply hose, minimizes kinking. Handle takes some tip as old one, but replacement and angle adjustment is now by hand instead of wrench.

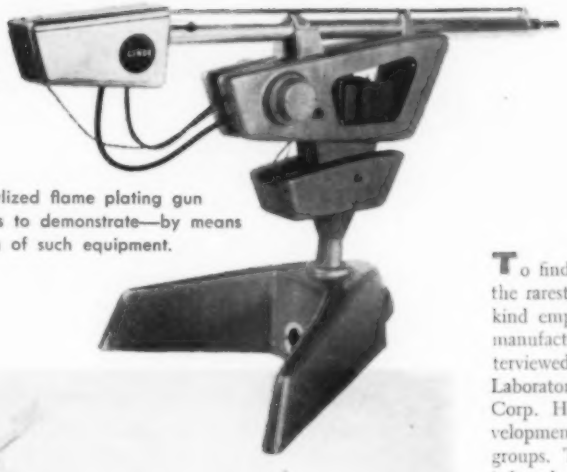


Robert Hayman at work on scale models of jet piercing machines (trailer unit, left; tractor model, right). Separate, enlarged model of piping and electrical system was also built, so all components could be assembled in operating positions—substantially reducing hydraulic engineering consultant's charges for working drawings.



Scarfing machine removes surface defects from metal billets and blooms.

Regulator for oxygen therapy equipment (above). Acetylene gas regulator used with small tanks (left)



Scale model of stylized flame plating gun used at trade shows to demonstrate—by means of lights—operation of such equipment.

Scale model of track-borne welding machine, complete with available accessories and optional equipment, permits sales and engineering departments to work out and demonstrate customer-specified arrangements of machine components.

Liquid nitrogen refrigerator, left, is for storing biological, chemical and metallurgical samples. Bulk oxygen storage unit is for hospital and industrial installations.

To find out what life is like for one of the rarest kinds of industrial designer, the kind employed full-time by capital goods manufacturers, PRODUCT ENGINEERING interviewed Robert Heyman, of Newark Laboratory, Linde Co., Div. Union Carbide Corp. Heyman services all of Linde's developmental, engineering and laboratory groups. The range of products involved is broad: metal cutting and welding equipment; scarfing, flame-plating and heat-treating machines; jet-piercing units (for mining); products for liquid-gas storage and control.

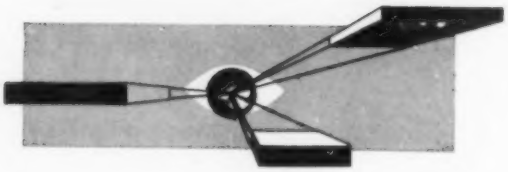
Developing such products has taught everyone at the Newark Lab that Heyman should be called in on human engineering and appearance questions in the earliest possible stages of product development. The earlier this occurs, the more flexible all decisive factors—both engineering and human—are likely to be—and the less money, time and energy will be wasted.

Such conferences may be arranged in advance—or Heyman may be called in at a moment's notice. They may take minutes of his time—or two years, in the case of the welding-torch handle illustrated on the opposite page.

Heyman learned how to weld in the process of designing this handle. He has spent days observing, under conditions of actual production, the operation of other equipment which he has helped design. Frequently, such studies will first take the form of scale models, constructed by Heyman in the shop expressly provided for this purpose. These models are then referred to constantly—and altered—as the new products they represent are developed, engineered and started through production for the first time.

The models have saved a good many dollars worth of engineering manhours in some cases, by making it possible to determine the relative positions, motions and dimensions of components. In other cases, they have permitted coordination of control devices with the systems concerned in the earliest stages of development.

After 13 years, Heyman reports that his department has proved its usefulness to the engineering staff, although, of course, individual engineers still may vary in their understanding and acceptance of industrial-design techniques and potentials. For his own part, Heyman has learned to accept and even take advantage of the points of coordination and compromise between appearance and engineering design.■



POINTS

THE QUESTION: ***Should Safety Be Legislated into Consumer Products?***

G C STEWART
Executive Vice-president
National Safety Council

"Sometimes yes, sometimes no . . .

It seems clear that legislation for safety is less likely to be enacted where industry has, by one device or another, developed an effective form of self-regulation. Great progress in safety for consumers has been made by cooperative effort among manufacturers and other interested groups. I have in mind the American Standards Association and its recent Z66.1 Standard on lead content of paint, which was designed to protect children from the possibility of lead poisoning. Other instances of consumer protection through cooperative standards, such as those of Underwriters' Laboratories and the American Gas Association, are too numerous to mention. In many instances the social considerations weigh as heavily as the economic.

"But the fact is, safety has been legislated into many consumer products for a number of years. The automobile, because of its size, may not often be thought of as a consumer product, but safety glass, windshield wipers, headlights, and brakes have for years been accepted as appropriate legislative matters, and more recently, turn indicators. In examining instances where legislation has been passed, the following features are often present: inability of the consumer to know of serious hazards; large numbers of people endangered; children endangered; and, from an engineering viewpoint, soundness of standards for compliance."

"Attempts to control product design . . .

through legislation or any other means tend to retard progress by removing incentive for further improvement and stifling competition. This certainly is not to say, however, that we oppose all regulation of product design features that affect safety. Our position simply is that regulation should be resorted to only when clearly necessary in the public interest. But if legislation does become necessary, we believe maximum freedom and flexibility should be provided in the statutes to permit design variation and improvement. And, certainly, competent technical guidance should be sought by legislators in framing any such laws.

"Our industry has cooperated through the years with state officials responsible for the regulation of motor vehicles. Most of this work has been carried on between the engineering committees of the Automobile Manufacturers Association and the American Association of Motor Vehicle Administrators. From time to time, however, we have encountered difficulty with statutes that too narrowly prescribe engineering specifications rather than simply set forth the safety standards required. Such situations have arisen, for example, in connection with headlight improvements. Automotive lighting throughout the nation is subject generally to state legislative control. In many instances, however, the statutes have allowed insufficient freedom for engineering progress. Each time the industry has developed better and safer headlighting, therefore, it has been necessary to go through the tedious process of requesting new legislation in many states to make the improvements fully legal throughout the country."

HARRY A WILLIAMS
Managing Director
Automobile Manufacturers Assoc.

OF VIEW

W E CRANSTON
Exec. Vice-president
Norris-Thermador Corp
Los Angeles, Calif.

"Safety can and should be legislated . . .

into consumer products when three factors are present. First, the public interest in the specific safety requirement must be sufficiently aroused. Secondly, the design requirements or the product modifications that are necessary to the public health and safety must be known. Thirdly, it must be possible to produce these safer products at a reasonable cost.

"A good example of this is found in the electrical industry where equipment designed for widespread sale must comply with the requirements of municipal codes, Underwriters' Laboratories standards, or both. Insurance companies took the initiative in developing these standards, with insurance rates providing a powerful incentive to encourage their wide adoption. Now, substandard equipment that can cause a shock or fire hazard when used in a reasonable manner is rare; and it is mostly limited to equipment of foreign manufacture that may be sold in rural areas where safety codes have not been set up or are not enforced.

"In Los Angeles, there's talk of legislative action to control smog for health and safety reasons. A consumer product—the automobile—is a major factor in creating this hazard, along with another consumer product—leaded gasolines. It is obvious that we can't legislate automobiles off the freeways, and no useful purpose would be served by legislation forbidding them to produce smog-forming exhaust gases. We have been trying for years to develop a catalytic muffler that would render these gases harmless, but the catalyst is 'poisoned' in short order by the tetraethyl lead added to most gas today. Obviously, this is necessary in today's high-performance engines.

"The idea of legislating safety into products has some merit, but many of the safety problems can be solved only by research and engineering. Where this is the case, as it is with our auto exhaust problem, lawmakers whose grasp of engineering subjects is limited can do more harm than good."

"No, safety cannot be ruled into products by law . . .

it can only be built into them by the manufacturer. Legislation will not guarantee a better product from an established and reputable manufacturer—on the contrary, legislation might well increase product cost and contribute to the inclusion of extraneous and unnecessary features. At present the quality manufacturer supports the National Board of Fire Underwriters and the Underwriters' Laboratories Inc, the National Electrical Manufacturer's Association, the American Standards Association and the kindred nonprofit organizations because of the common betterment derived from these associations. In contrast, if safety were to be legislated into products, such legislation would be meaningless without a system of policing and checking. This would require a tremendous organization and extensive laboratories which at best would only duplicate facilities already in existence. Obviously the cost of this system would revert to the consumer through taxation and through the increased product cost made necessary by the manufacturer's support of the government program.

"The manufacturer has an obligation to the consumer to the extent that he must engineer, design and make products which, when used sensibly, will not be hazardous and will in no way reflect anything but credit upon American industry. Legal restrictions cannot improve upon this obligation. An interesting illustration of this is the automotive industry which has thoroughly incorporated safety in the product, but the consumer chooses to abuse common sense in spite of legislative restrictions. Legislation cannot make the product safer—safety is provided in original design and must be practiced in everyday use."

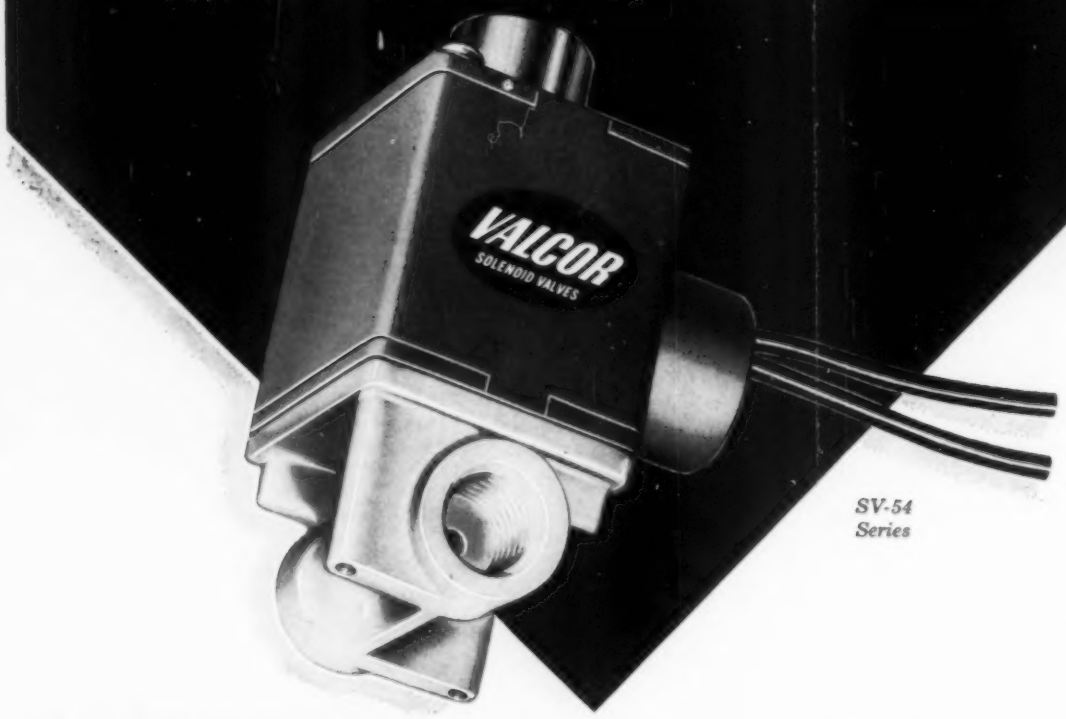
E C AMBLER
Director of Engineering
Landers, Frary & Clark
New Britain, Conn.

New 3-Way Nylon-Body Solenoid Valve...

List Priced as Low as $10.75...

(Quantity Discounts Available)

Outlasts, Outperforms Steel!



SV-54 Series

VALCOR'S new 3-way Nylon solenoid valve, SV-54 Series, outlasts and outperforms steel, yet is list priced as low as $10.75! In general purpose and O.E.M. installations, where millions of operating cycles are essential, this new Valcor valve not only works best but costs less.

Its nylon seat outlasts steel...its port threads outlast steel... pound for pound it's *3 times stronger than steel.* Dry seal threads, no compound is needed—and they won't loosen even under severe vibration. Nylon is non-corrosive so you have no atmospheric problems. And the stainless plunger is a reliable workhorse for millions of cycles. Bubble tight sealing. Available in normally open, normally closed and "directional control" configurations in all normal AC and DC voltages...1½" square x 3" long (valve illustrated).

Write today for complete technical data on this shock-resistant, pressure-proof valve—the 3-way nylon-body valve, SV-54 Series, that's 3 times stronger than steel, yet costs less. Try it on your toughest application.

VALCOR SOLENOID VALVES

VALCOR ENGINEERING CORP.

5375 Carnegie Avenue, Kenilworth, New Jersey

SIGNIFICANT COMPONENTS • MATERIALS • PROCESSES

Self-lubricating bearings . . .

and parts are for 750 F max continuous duty, 1000 F for intermittent periods and 1500 F in nonoxidizing atmospheres. Made of carbon graphite impregnated with copper or silver, depending on use. Material has been designed for such applications as jet aircraft and hot conveyors, and as self-lubricating contacts, brushes and positive-torque friction disks. For most standard configurations, about 20 to 50% higher in price than ordinary carbon. 2 to 4-wk delivery. **Metallized Carbon Co, South and Water Sts, Ossining, NY.**

Circle 11, Reader Service Card

Alloy gains stressed parts . . .

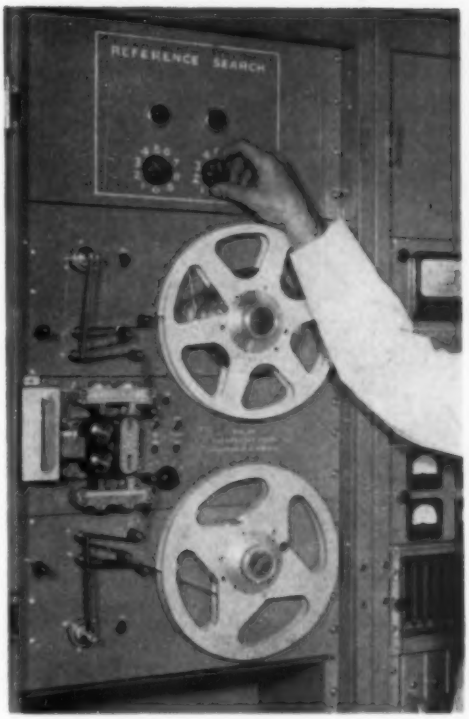
at temperatures to 1050 F. Air-hardening, weldable and martensitic steel alloy is said to be free from weld-cracking without preheating or postheating. Weldments can be cold-worked after stress-relieving or annealing. Metal is essentially a 12% chromium-1½% nickel composition with high tensile strength and good ductility. Said to be more weldable than stainless type 410 and to have a more uniform structure and higher hardness than type 405. When annealed, blanking, drawing, forming and cold-heading operations are said to be possible. May be machined in treated and annealed conditions. Offers resistance against a wide range of corrosives and to scaling at elevated temperatures. Can be used for continuous service up to about 1200 F. Forms now available include bars and forgings, wire and wire rods, and strip. Price is comparable with that of stainless type 414. 4 to 6-wk delivery. **Carpenter Steel Co, Reading, Penna.**

Circle 12, Reader Service Card

Non-slip epoxy coating . . .

is a synthetic compound consisting of a plastic, a hardener and an abrasive. Plastic and hardener are applied and, while wet, abrasive grain is broadcast onto the compound. Variations are used to provide non-slip sidewalks, boat decks and similar surfaces. When dry, abrasive surface acts as protective coating. Resin is said to have excellent impact resistance; to resist action of solvents, acids and alkalis; and to be waterproof, have high strength and toughness and be nontoxic in service. About 94 to 71 cents per lb in 8½ and 35-lb units, depending on quantity. Delivery 1 wk to 10 days. **Howe & French Inc, Weymouth, Mass**

Circle 13, Reader Service Card



Tape searcher selects

up to 100 specific parts or parts reference points for functions in automatic control. Selective control permits inclusion of many functions on one reel of tape, reducing tape storage-space requirements. Operator selects reference point, machine control tape is automatically repositioned to beginning of selected function and an optional 2-digit decimal display indicates starting point. Interruptions and breakdowns are handled by automatically backing up tape to desired reference point by return-to-reference-button. Electronic construction of machine control unit permits tape reader to control up to 80 on-off auxiliary control functions punched in a special code. About 1-mo delivery. **Industrial Controls Div, Bendix Aviation Corp, 21820 Wyoming Ave, Detroit 37.**

Circle 14, Reader Service Card

Optical transducer . . .

for use in conjunction with electronic tachometers, measures rotational speeds of over 1,000,000 rpm. Unit contains photo-transistor, light source and lens system. Transducer detects, by optical reflection, graduated lines on moving surface to be measured. Adhesive-backed Mylar film with lines printed on it is applied to shafts, couplings or other surfaces. Said to be virtually insensitive to vibration over a wide frequency and amplitude range. Grease, oil or dirt is said not to affect unit's better than 1% accuracy. **Southwestern Industrial Electronic Co, 2831 Post Rd, PO Box 13058, Houston 19.**

Circle 15, Reader Service Card

design in CAMLOC . . . design out costs

2 new QUICK OPERATING FASTENING DEVICES

CAMLOC

MODEL 7C
HARNESS CLAMP

speeds up installation and maintenance

- Opens or closes with a quarter turn
- Clamp captive to structure
- Easily mounted with rivet or bolt
- Holds wire bundles, hose, cable, conduit
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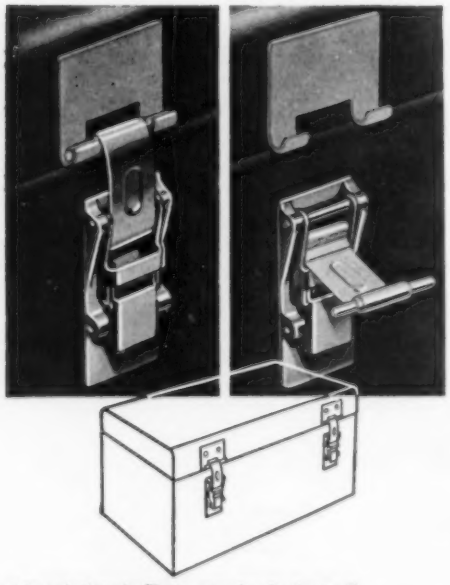

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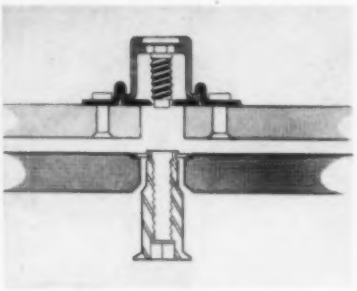

Structural panel fastener . . .

in standard and self-sealing types, is now available in two-lug and corner-mounting styles. Self-jacking action of sleeve bolt is said to eliminate binding problems when removing panel. Fastener permits panel misalignment of 0.040 in. max per hole and closes gaps to ⅛ in. Sleeve bolt is removable and receptacle replaceable without drilling out attaching rivets. Receptacle is self-draining to prevent moisture accumulation. **Nutt-Shel Co, 2701 S Harbor Blvd, Santa Ana, Calif.**

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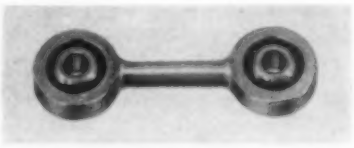


Control-rod assembly . . .

is for applications where a fixed nonadjustable center distance between joints can be used. Said to cost less than two-rod end assembly of comparable size and to save assembly labor costs. Welded construction permits manufacturing economies on up to a 12-in. center to center distance. Hardened and ground spherical race retains self-aligning balls and results in long cycling life at high or low velocity. Sintered bronze or iron-copper ball (depending on application) is oil-impregnated. **Carter Engineering Co, Farrysburg, Mich.**

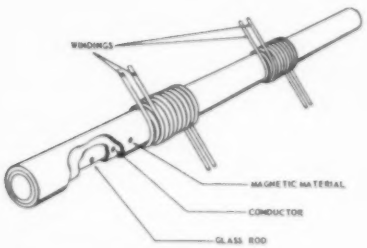
Circle 17, Reader Service Card

Solid-state thermistors . . .

are temperature-sensitive switches whose resistance increases abruptly when a specified desired temperature is attained. When used for over-temperature protection of hermetic motors, they are installed directly in windings to operate a small external relay, deenergizing motor or giving signal when over-heating occurs. Sentitivity is said to be many times that of conventional thermistors, and temperature ranges in which switching occurs are sharply de-

fined and controllable. Thermistors for motor over-temperature protection will switch at specific temperatures between 212 and 257 F and will function in control circuits requiring a 17:1 ratio of max to residual resistance. The thermistors, roughly the size of aspirin tablets, are surfaced on opposite faces with a metal coating. Before use, they are fitted with leads and encapsulated in an epoxy resin. **Westinghouse Electric Corp, Box 2278, Pittsburgh 30.**

Circle 18, Reader Service Card



Fast magnetic switcher . . .

has demonstrated speeds to 4 millimicrosec. The device, a glass rod with magnetic coating, serves both as a switching and information storage element. Said to be usable in word-ordered and coincident current memory circuits and to lend itself to less expensive mass-production techniques in fabrication and testing. Storing information requires 20 thousandths w. Operates at temperatures 300 F higher than conventional components. Has been switched continuously at 5 mc repetition rate without adverse heating effects. About 15 thousandths in. dia with length depending on capacity desired. **Electronic Div, National Cash Register Co, 1401 E El Segundo Blvd, Hawthorne, Calif.**

Circle 19, Reader Service Card

In-line digital readout . . .

uses selective group switching. Displayed characters are said to be easy to read, even with high ambient light and at viewing angles up to 150°. In-line, in-plane presentation eliminates confusion. Units consist of resistor matrix and neon bulbs utilizing a printed circuit plug-in connector. Multiple units arranged in-line occupy 1 x 1¼ in. panel area per digit. Characters are ½ x ⅞ in. Power consumption and heat generation are said to be 1 w max per digit at 150 c. From $15 in sample quantities to $5 in production quantities. **Electronic Equipment Div, IDEA, 7900 Pendleton Pike, Indianapolis 26.**

Circle 20, Reader Service Card

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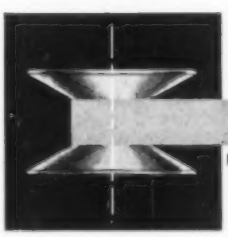

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PE-12

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SIGNIFICANT COMPONENTS MATERIALS PROCESSES . . .

Magnetic readout encoder . . . has no mechanical or optical contact and only passive circuitry. Analog-to-digital converter is said to be unaffected by heat, cold, humidity, dirt, dust and other adverse industrial conditions; to be unaffected in accuracy or life by number readouts, rate of readout or whether readout is in moving or stationary system. Input can be any shaft position indicator; binary code output can be fed directly to amplifier and control circuitry. Magnetic readout involves a shaft-mounted barium ferrite disk that is radially spot-magnetized in concentric code spots. Microminiature toroid is mounted close to, not touching, disk, above code spot track, interrogating with constant current pulse. Augular position can be determined by output pulse, within ½° resolution of disk, at rest or rotating to 10,000 rpm. Interrogation rate can be 5 million pps max. Model is 3¾ in. dia x 1.39 in. long. Breakaway torque is 0.2 in.-oz. **Applied Science Corp of Princeton, PO Box 44, Princeton, NJ.**

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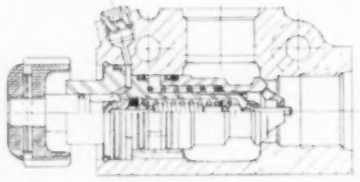

Pilot-operated relief valve . . . has two pressure chambers, which operate pilot, maintaining constant pressure without noise or chatter. Pilot is held open by pressure in main chamber. Two parts are connected to hydraulic system and sump. A third is introduced when used as sequence valve. Pressure can be adjusted. Valve limits max operating pressure at constant level, though flow varies. No leakage loss below cracking pressure. Pilot valve controls pressure setting and main valve instantly conforms. Less than 50 psi between cracking and closing and less than 100 psi differential from trickle to full flow. As a pressure regulator, it maintains constant pressure from ¼ to 30 gpm max. Valve is made in 15, 30 and 80-gpm capacities. **New Products Corp, 3636 Oakton St, Skokie, Ill.**

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NEW LITERATURE

Man, the Maker

R J FORBES, Published by Abelard Schuman Ltd, London and New York 5½ x 8½, 365 pp, $5.

While many recent annals relate the history of science and technology to its effects upon man, his society and his future, *Man, the Maker* tries a new twist. It is the story of man's development as a tool-using animal. The goal Dr. Forbes has set for himself is a task of Gargantuan dimensions. A history of technology and engineering condensed to 350 pages can not hope to delve too deeply into the subject.

Starting with man's early artifacts, Dr. Forbes takes us chronologically through the development of fabrics, road building, architecture, mining; then through the development of transportation and power. The book ties a multitude of facts to the central theme, that progress in science and technology is the accumulated heritage of the past, the combined experiments and striving of hundreds of generations in all parts of the world.

Unfortunately too much time was spent gathering these facts and dates and not enough arraying them in the proper order. It would have been more interesting to find out the how's and why's of some of our more important inventions. —*BAL*

How Much Science at Your Fingertips?

Suggestions are presented for helping to learn and retrieve scientific information, with or without artificial aids. Comparisons are made between capacities of brain and computers. Some new research is described.

"How Much Science Can You Have At Your Fingertips?" I J Good, IBM Journal of Research and Development, Oct '58, 590 Madison Ave, New York 22.

LAMINATED PLASTIC—Bulletin, 4 pp. Includes structural applications, test data on properties. Formica Corp, 4614 Spring Grove Ave, Cincinnati 32.

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CASTERS—Catalog 556, 24 pp. Describes and illustrates casters, leg equalizers, glides, leveling screws and sockets. National Lock Co, Rockford, Ill.

Circle 2, Reader Service Card

GEAR FACILITIES—Bulletin 26 IG, 12 pp. Illustrated information on plant facilities, quality control, capacities, types, processes, materials, heat treatment and equipment. Illinois Gear & Machine Co, 2108 N Natchez Ave, Chicago 35.

Circle 3, Reader Service Card

INDUSTRIAL DESIGN SERVICE—Brochure, 8 pp. Brief review of personnel and design studios. Included are several examples of work. VIE Design Studios, Dayton St, Yellow Springs, Ohio.

Circle 4, Reader Service Card

CRYOGENICS—News sheet, Kelvin Scale, Vol. 1, Issue 1. Information on cryogenics and related subjects. To be published periodically by Arthur D Little Inc. Formerly called Cold Facts. Kelvin Scale, 20 Acorn Park, Cambridge, Mass.

Circle 5, Reader Service Card

STORY OF TECHNOLOGY—Booklet, 36 pp. Describes large corporation as a principal element in technology. Points out many technical problems still unsolved and needs of the future. Explains some of research and developmental work underway in DuPont today. E I Du Pont De Nemours & Co Inc, Wilmington 98, Del.

Circle 6, Reader Service Card

ENGINEERING & RESEARCH FACILITIES—Brochure, 16 pp. Details company's research and development organization, and personnel working in 16 areas of current technology. Also contains biographies of key personnel. Alco Products Inc, Schenectady 5.

Circle 7, Reader Service Card

AC GENERATORS—Brochure ACG958, 16 pp. Describes construction, specifications, performance of line of brushless alternators. Kato Engineering Co, Mankato, Minn.

Circle 8, Reader Service Card

SQUARED INTERCHANGEABLE CYLINDER—Bulletin SQ 10-58, 6 pp. Line drawings describe standard cylinders and construction details. Tomkins-Johnson Co, Jackson, Mich.

Circle 9, Reader Service Card

CORROSION-RESISTANT ALLOYS—Bulletins F-30,106 and F-30,127, 12 and 4 pp Brochure on Alloy B, a nickel-base alloy, discusses chemical composition and properties; gives performance curves. Brochure on cast nickel-base Alloy D presents physical, chemical and mechanical properties, as well as a chart on penetration rates for sulphuric acid. Haynes Stellite Co, Div Union Carbide Corp, Kokomo, Ind.

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Publisher's Postscript...

We need your opinion

Chatting with a reader the other day, we asked where he read his copy of Product Engineering—at home or at the office. "I read it at home, and I really tear it apart," he said. "I keep a pair of pliers in a drawer next to my chair, and even before I start, I pull out the binding staples. In that way I can easily remove all the articles and advertisements I want to save. You publish so much information that I want to file and keep that I found the use of the pliers the best way to get uniform-sized and untorn pages."

This conversation reminded us of the many discussions we've had here about perforating all the pages, both editorial and advertising, close to the binding edge for easy removal. At first the idea was tabled because the print shop did not have the necessary facilities for doing the job on a high-speed weekly schedule. Later we felt that perhaps many subscribers would not like the practice because on a routed copy it might be too easy for pass-along readers to remove articles and advertisements, to the disadvantage of others on the routing list.

We recognize all the advantages and the disadvantages of perforated pages. At the same time, the large number of requests we get each week for article reprints clearly demonstrates how many readers remove and save parts of the editorial and advertising content. If we perforate all the pages at the binding edge, you will be able to remove any of the published material easily (no need for a pair of pliers) and end up with all the removed pages of a uniform size for easy filing.

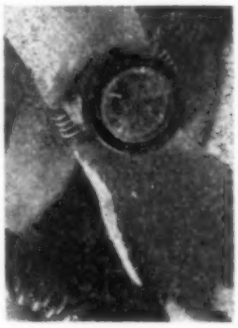
The print shop is now equipped to do the job. The big question is: DO YOU WANT IT? It would add to our already high production costs to do this job, and naturally we don't want to undertake it unless you'd like it. On the other hand, if you feel it would be a service to you, we'll go ahead. We'd appreciate your vote. Our plan would be to start perforating the pages of the Design issue first, and later on include this R & D issue.

WILL YOU CAST YOUR VOTE? just write in the space headed "SPECIAL DATA" on the reader service card facing this page: Write *YES* if you'd like to see the pages perforated for easy removal, and *NO* if you're against it—sign your name and address and drop it in the mail. Your vote will help the editors make a tough decision.

—AH

For Your Information (personal)

Depth gage for skin divers



Going on a winter vacation? No need to swim around in the dark with all those fish, while wondering how deep you are. For $7.95, you can now buy this luminous-dialed wrist gage that gives the straight (down) facts. It's a bourdon-type device that features a break-resistant Tenite butyrate plastic case and a pressure-resistant lens of the same material. US Divers Co, Los Angeles 64, makes it.

Telephones for tomorrow

What does the future hold for business and home phone-users? Someday, we may be communicating by brainpower alone. But, for 1959, the Bell System promises these innovations: an *order turret* for those needing 20-40 trunks; a *home communications system* for "medium-sized and large homes" that hooks up several phones in the house and the front-door speaker as well; a new, smaller *telephone* with an oval base, for general use; a *message-waiting telephone*, with a light controlled by the central operator, to tell when another call is coming in; and a handsome, streamlined *call director*, with 18 keys and a dial, to replace the present 101-key box.

Just throw it in the washer

The small home appliance which can't go right from the dinner table to the dishwasher seems out of date these days. To the long line of "submersible" fryers, pressure cookers, and griddles, National Presto Industries has now added the percolator pictured here. The manufacturer says it can not only be washed in water, but even be put in the dishwasher. Heating element and thermostat are sealed in the base.

Incidentally, while the trend toward submersible equipment is most marked in the small-appliance field, it's by no means confined to that area. Much military equipment of course requires submersibility, and there is an increasing demand in industry for motors and other components which can at least take wetting in the rain *(PE—Sep 15, p 80)*.

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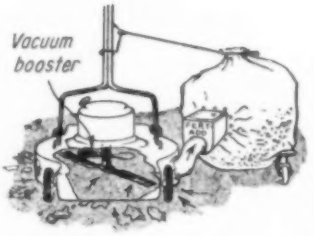
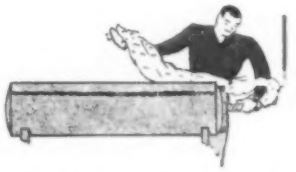


. . . a power-mower type collector for leaves. One that chops the leaves as they pass to a plastic expandable bag, thus preparing the leaves as mulch, and bagging them for future use or burning. An additive to aid the mulch to become fertilizer could be poured through a valve near the opening of the bag automatically. —B. Bonsal

. . . something new in erasable writing instruments. The ballpoint pencil is an attempt in the right direction. The ideal instrument would also require no resharpening. It would deposit an erasable line (but not by means of rubbing) of constant width and color. The dye need not be limited to carbon, paste or ink—it could include static or chemical deposits on treated papers.
—V. J. Tarjan



. . . a polyethylene liner of various sizes to be inserted into welded tanks of all kinds (hydraulic reservoirs, high-pressure cylinders, etc.). The liner would prevent weld slag and spatter, which is impossible to clean out, from getting into the contents.
—T. A. Sikorski, Jr.

. . . variable-volume paint cans. The lid might move down into the can and seal against the inner sides for storage without the usual trapped air. Released and removed entirely, the lid would leave a large opening for the paint brush and a smooth lip. —M. L. Stone

Have you a pet subject but neither the time nor inclination to do the necessary R & D? Product Engineering will welcome (and pay $10 each for) similar ideas based on known scientific principles but lacking an inspired manufacturer

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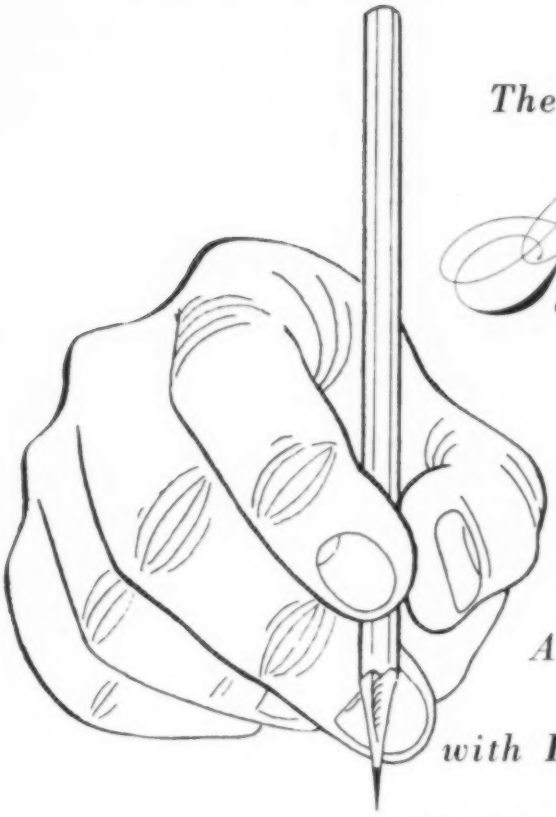
The Hand with the

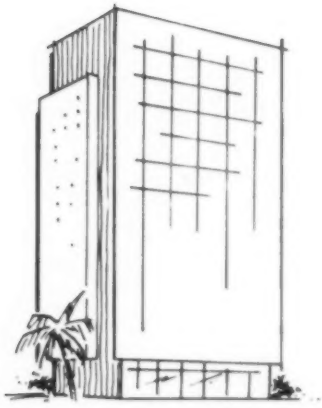
Golden Touch

uses

A.W.Faber-CASTELL

with Black Gold Graphite





Who are the men with the "golden touch"? They are the architects turning out attractive renderings and perspectives; engineers drawing plans of extensive projects; designers creating bold new shapes and forms, and draftsmen making meticulous drawings and tracings.

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